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AUTOMOTIVE INDUSTRIES

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Bus-Rail Interests Form New Group

National Trailways System Will Operate 1500 Buses on Coast-to-Coast Routes

By George Applegren
Special to Automotive Industries

Behind the association of bus systems, setting up a new coast-to-coast passenger service, are the railroads. While definite word to that effect was not contained in the announcement made, the presence of three of the larger trunk lines in the initial set-up and the word that "negotiations are under way which will see other bus systems, notably railroad operated systems, joined" calls for that statement.

The new network, known as National Trailways System, begins operations over approximately 150,000 miles daily. The group includes the bus operations of Santa Fe Trails System, the Burlington Transportation Co., the Missouri Pacific Transportation Co., the Frank Martz Coach Co. and the Safeway Lines.

In all, more than 1500 pieces of equipment are thrown into the pool. Operations at present are said to be in 27 states with more than 500 terminal and waiting-room stations.

H. W. Stewart, general manager, Burlington Transportation Co., is chairman of the managing committee. Other members of the committee include: A. E. Greenleaf, vice-president

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Labor Split Patched?

Dillon and Other U. A. W. Officials Cooperate for April Convention

Delegates representing more than 25,000 active dues-paying members of the United Automobile Workers International Union are being called into convention in South Bend starting Monday, April 27. Official call was sent out by F. J. Dillon, general president, and Ed Hall, general secretary-treasurer, with the approval of William Green, president of the American Federation of Labor. The most important business of the convention will be the election of international officers.

William Green will be present to address the convention and to confer with officers and delegates. It is assumed that he will interpret the meaning and define the significance of the A. F. of

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Packard's Plans

Small Possibility of Introducing New Six for 1936 Market

Reports that Packard Motor Car Co. will enter the 1936 automobile market with a light six-cylinder car are not taken seriously by those who are familiar with the task involved in bringing out an entirely new line.

While the company is noncommittal, it is understood that machine tool orders for such a car are being placed. However no preparations are as yet in evidence at the factory and it is learned on good authority that no plans have been made for its introduction during the current model year.

But on the theory that where there is smoke, there must be fire, the trade

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N.L.R.B. to Hear Complaint Against Highway Trailer Co.

The National Labor Relations Board has announced that a hearing will be held at Madison, Wis., March 19 on a complaint of the United Automobile Workers of America that the Highway Trailer Co., Edgerton, Wis., has discriminately discharged a number of employees.

March Sales Spurt; Drain Field Stocks

Factories Lift Operating Rates as Dealer Orders Call for Rush Shipments

By Harold E. Gronseth

A very definite upturn in retail sales of motor vehicles is in progress, according to all evidence available to the factories.

Most important, of course, are the actual delivery figures now coming in for March which show that the buying wave generated with the break in the weather last month is swelling at an encouraging rate. First week's reports show increases of 17 per cent to 25 per cent over the last week of February, which marked the first big rebound from the winter's low level.

Further indication is found in the rate of dealers' orders, which is reflecting more promptly than anticipated the changed condition of the retail market. Companies that went into March with what they considered ample field stocks found that before the month was many days old a sizable volume of dealer orders calling for rush shipments had developed. The result is that heavier operations have been slated for the coming week. Plants that were on a four-day week are going back to the five-day basis. On the whole, a considerably heavier output is expected to be

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Goodyear Decision

Repercussions Expected to Affect Legislative and Trade Circles

Action of the Federal Trade Commission in ruling the Goodyear-Sears contract a violation of the Clayton Act is expected to create nation wide interest in, and demand for clarification of Federal laws governing mass buying and distribution, with interest for the moment centered on the Patman bill, now pending in congress. (For a detailed account of the F.T.C. decision see Automotive Industries, March 7, page 355.) In its annual report, the Federal Trade Commission commented significantly upon the Goodyear case and recommended revision and srengthening of the Clayton Act along the lines now pending by specifically curbing quantity discounts.

One of the major findings of the commission, not stated in the formal re-

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Liquefied-Gas Fuels

Favorable Results Shown In Commercial Use

Oil refineries in working the cracking process have been producing large quantities of liquefiable gas. For use in gasoline engines, these gases have many advantages. They eliminate all troubles in connection with charge distribution, they leave no carbon deposits, and there is practically no carbon monoxide in the exhaust. In consequence of the elimination of distribution difficulties it is possible to use as large an inlet manifold as one desires. Since the fuel does not enter the cylinders in the liquid state, there is no doubt that the mechanical wear of the engine is greatly reduced.

These were contentions of A. Ludlow Clayden, Sun Oil Co., at the March meeting of the Philadelphia Section, S.A.E.

Sun Oil Co. and other refiners have been selling liquefied gas for heating and cooking, and Mr. Clayden made some tests with the fuel in the CFR test engine. The Sun Oil Co. decided to use the fuel in the engine of a truck used for the delivery of the liquefied gases to customers, and asked the White Co. to adapt one of its engines to it by increasing the compression ratio to 10 to 1. It was found difficult to reduce the compression space as much as required to obtain this ratio, but a ratio of 8 to 1 was obtained, and power tests were made on the engine with this ratio by Mr. Jehle of the White Company. The maximum gas-pressure obtained in this engine with this compression ratio was within 15 lb. per sq. in. of the figure found by Mr. Clayden in the CFR engine with the same compression ratio.

(*Turn to page 396, please*)

Eyston Will Try for World Record with 12-Cyl. Diesel

The Diesel engine with which G. E. T. Eyston set up the first 24-hour world record, on Montlhery track at an average of 94.99 m.p.h., was an Associated Equipment Co.'s six-cylinder unit practically identical with the 1200 now in use on London buses. Eyston averaged 98.79 miles for the first three hours, 98.48 miles for six hours, and 98.05 for twelve hours. Rain fell for the last ten hours of the run, thus bringing the average down to 94.99 miles for the full 24 hours. Twelve world records were captured during this run.

The engine has six cylinders of 115 mm. (4.53 in.) by 146 mm. (5.75 in.) bore and stroke, giving a piston displacement of 9090 cc. (555 cu. in.), and weighs complete with flywheel, electrical equipment, oil filter and all accessories, 1477 lb. The cylinders have removable liners and the two cylinder heads are of aluminum alloy, with overhead valves having pushrod operation. The C. A. V.-Bosch injection system is used.

Using the standard engine and transmission, Eyston built a special chassis and fitted a one-man saloon body with the fuel tanks inside it.

Attempts on the one-mile world record are also being made by Eyston with a 12-cylinder Diesel fitted into the front drive chassis with which he broke the world's 24-hour record in Utah last summer. Eyston aims at attaining a speed of 140 miles an hour.

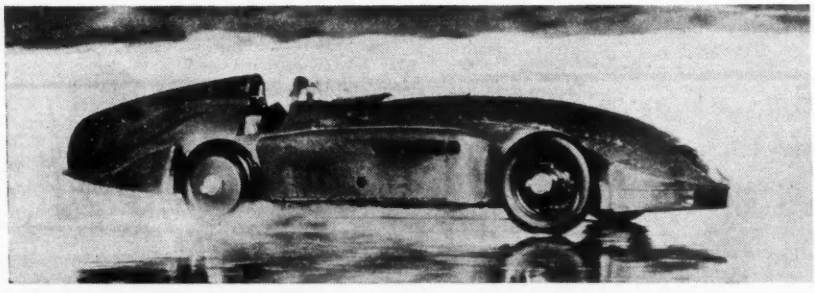
Miley Buys Brake Band Division of Duro Metal

The L. J. Miley Co., Chicago manufacturer of brake lining has purchased the brake band division of the Duro Metal Products Co., also of Chicago. Added to the Miley "packaged sets" this line of bands will expand the Miley "Exchange Service" line to take in older models of Buicks, Dodges, Chevrolets, Oldsmobiles, Pontiacs, Essex and Whippets; Fords and Chevrolet bands having always been a part of the Miley line.

Federal Truck Awarded Big War Dep't Order

Federal Motor Truck Co. has been awarded by the War Department a contract for 193 trucks to cost approximately $250,000.

February sales were about 30 per cent larger than a year ago, maintaining the same rate of gain shown in January as compared with the previous year.



The "Flying Spray," Capt. George Eyston's racer with a secret Diesel 12-cylinder aero-engine, undergoes tests on the Pendine Sands, Carmarthen.

Gramm's New Trucks

Chassis Prices Range From $565 to $1,795 on Ten New Series

Gramm Motor Truck Co., Delphos, Ohio, announces ten new series of trucks, the differences in each series being in the lengths of wheelbase. Gross-load ratings range from 9500 to 20,000 lb., and prices range from $565 for the 1½ to 2-ton, 136-in. wheelbase chassis with cowl, to $1,795 for the 4½ to 5-ton chassis. As far as possible, the same chassis units are used in several of the lines, and there are altogether five engine models, two sets of engine electrical units, three clutches, three transmissions, two emergency brakes, three universal joints, three steering gears, four front axles, and six rear axles.

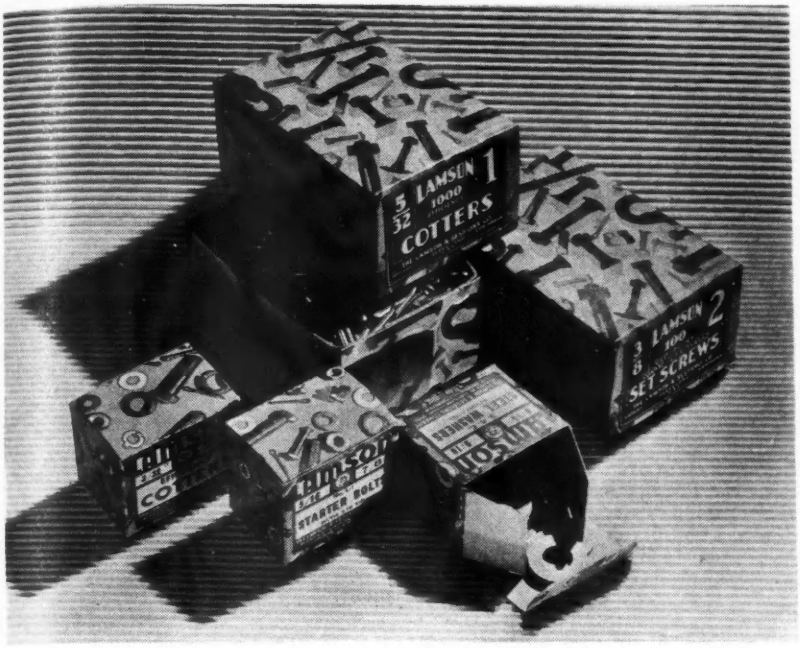
The rear axles are of the spiral-bevel-drive type, and all except the smallest size of axle used have thrust blocks with screw adjustment behind the gear ring. Radiators have a modified three-point support, the radiator being cushioned and dampened, and anchored to the cowl. Fenders are of a new design. The radiator grille also is of new design, with rectangular openings.

For extra-heavy duty, the eight larger series can be supplied with special engines having crankshafts of chrome-molybdenum steel, precision-type cadmium - nickel bearings, exhaust - valve inserts, and an oil conditioner. The seven smaller series are regularly equipped with four-speed transmissions, while the three larger series come with five-speed transmissions having silent third and fourth-gear speeds. Either a dual-reduction rear axle or a five-speed transmission with quiet helical overdrive (fifth speed, direct-drive fourth speed, and quiet helical third speed is available as an option on any of the lines. All of the trucks have cam-and-lever steering gears.

All of the trucks have hydraulic brakes, with cast iron drums and molded linings. Bendix boosters are standard on the larger models and available as extras on the remainder. Trailer brake connections are available as extras. All universal joints in propeller shafts are of the needle-bearing type. Engines have been moved farther forward, to improve load distribution and provide additional space for cabs. A new cab, more roomy and comfortable, is available.

On the larger models the front springs are longer and wider than formerly and are provided with rubber bushings of the compression type. Rear ends of rear springs in the larger models bear on brackets with hardened wear plates which eliminate shackles. All spring leaves are of alloy steel.

Timken-Detroit Axle Co. has dissolved the following previously wholly owned subsidiaries which hereafter will be operated as divisions: Timken Silent Automatic Co., Wisconsin Axle Co., Michigan Valve & Foundry Co., and the Timken Michigan Co. The latter, a sales company, has been merged with the Michigan Valve Division.



. . . . in Good Packages

So said *Modern Packaging* and awarded a Silver Medal in its All-American Package Competition to Lamson & Sessions for their unique design of folding carton.

All-Service Vehicles

Gas-Electric Buses Can Also Be Operated from Trolleys

The 62 "all-service" buses recently put into operation by Public Service Coordinated Transport of New Jersey are equipped with 450 cu. in. engines, having a normal rating of 125 hp., but increased to approximately 160 hp. at 2400 r.p.m. through supercharging. This constitutes one of the first applications of the supercharger to buses.

The "all-service" vehicle, as the name indicates, operates either as a trolley coach from overhead wires, or as a gas-electric bus in which the electric drive takes the place of the conventional transmission. Provision is made for lowering the trolley poles to the roof by means of electrically operated retrievers, so that when the end of the electric line is reached, the driver can, without reducing his speed or leaving his seat, shift to gasoline operation.

The performance of these vehicles has proved so satisfactory that Public Service recently placed an order for 25 additional "all-service" buses. One of these is to be equipped with a single electric motor in place of the two now used, and will be Diesel powered.

NADA Vote Favors Gross Profit Plan

Large Majority of 7000 Dealers' Ballots Approve Used-Car Profit Control

The percentage of automobile dealers voting on the proposal to establish a gross profit in the used car department of their business as a means of eventually stopping present losses shows an increase favorable to the proposal, according to the National Automobile Dealers Association.

The voting is on three questions. On the first, "Do you approve recommendations outlined in the booklet 'The Establishment of Gross Profit in the Used Car Department of Automobile Dealers'?" explaining the proposal in detail, those favorable constitute 91.2 per cent of all voting. On the second question, "Are you individually willing to accept the responsibilities and obligations as set forth in the booklet?" 87.4 were favorable. On the third question, "Will you support your national association actively through membership in its efforts to make the recommendations effective?" 90 per cent voted "yes."

The percentage favorable to the plan goes higher when volume of units sold in 1935 is considered, being 92.7 per cent. The Chrysler group to date shows 89.7 per cent favorable; General Motors dealers, 93.2 per cent favorable; Ford dealers, 95.9 per cent favorable, and the miscellaneous dealer group, 85.3 favorable.

Ballots are continuing to come into N.A.D.A. headquarters, indicating a widespread interest in the proposal, it was stated. To date, it is estimated that approximately 7000 dealers have given a favorable response, either by ballot vote, at group meetings of dealers at which the program was explained by speakers, or through resolutions adopted by state and local dealer associations.

Correction

The specifications of the Duesenberg engine shown under "American Passenger Car Power Plants" on page 254 of the Statistical Issue of *Automotive Industries*, Feb. 22, 1936, should read: bore 3¾ in., stroke 4¾ in., taxable hp., 45; piston displacement 419.7 cu. in.; piston speed at maximum hp. (ft. per min.) 3300, b.m.e.p., 119.3.

General Motors' February Sales Lower, but Ahead of Last Year

In spite of the slowing-up of sales by bad weather during the month, General Motors' sales of cars to consumers in the United States last February amounted to 96,134, compared with 77,297 in February, 1935. Sales to consumers during the first two months of this year were 198,168, compared with 131,402 for the same months of the previous year.

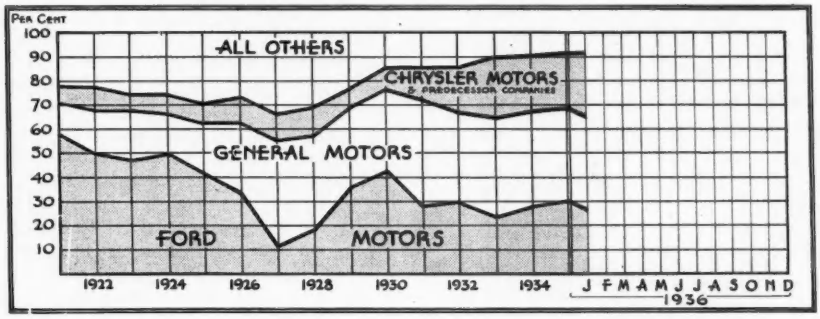
Sales of General Motors' cars to dealers in the United States totaled 116,762 in February, compared with 92,907 in February a year ago. Sales to dealers for the first two months of 1936 totaled 247,896, compared with 168,634 for the same two months of 1935.

February sales to dealers in the United States and Canada, together with overseas shipments, totaled 144,874 compared with 121,146 a year ago. Sales in January were 158,572, and for the first two months of 1936, 303,446, compared with 219,414 for the same two months of 1935.

The accompanying table shows General Motors' sales for January and February of this year, February of 1935, and the totals for the first two months of this year and last.

	Feb., 1936	Jan., 1936	Feb., 1935	Two Months 1936	Two Months 1935
Sales to world dealers.....	144,874	158,872	121,146	303,446	219,414
Sales to U. S. dealers.....	116,762	131,134	92,907	247,896	168,634
Sales to U. S. consumers....	96,134	102,034	77,297	198,168	131,402
Change in U. S. dealer stocks	+ 20,628	+ 29,100	+ 15,610	+ 49,728	+ 37,232
Overseas shipments	28,112	27,738	28,239	55,550	50,780

Proportion of Passenger Car Production by Major Groupings



Authentic monthly production figures for individual companies in the passenger-car field have been grouped above to show the competitive position of the major producers. This chart will be continued each month as figures for the preceding month become available.

Goodyear Strike Parleys Bring Settlement Nearer

Peace negotiations in the Goodyear strike at Akron are progressing, but there is no indication yet of when the strike will be settled. Goodyear directors, meeting in Cleveland, March 10, rescinded an appropriation of $1,250,000 for plant improvements, which had been made before the strike started Feb. 17.

Members of the Goodyear local, United Rubberworkers Union, received the peace proposal of P. W. Litchfield, president of Goodyear, but did not act upon it, drafting instead a counter proposal, which the company now is considering.

The Goodyear proposals were:

1. All employees as of Feb. 2 to return to their jobs without discrimination.

2. The company will deal with all employees individually or through their chosen representatives.

3. The company will give notice to representatives of employees affected when wage rate adjustments are to be posted.

4. A standard 36-hour week and six-hour day will prevail in tire divisions and any change in these hours per day or per week, above 36 or below 30, will be adjusted by arrangement with the employees in the departments or divisions affected.

5. Layoff notices will be made in duplicate, one going to foremen and the other being kept in the labor department office, open for inspection.

The union demands:

1. Return of all employees as of Feb. 12 without discrimination.

2. Clarification of Clause 2 of the company's proposal so as to set up definite grievance adjustment machinery through shop and department union committees and assurance of the right of the union to use its president (not an employee) in grievance dealings.

3. Clarification of Clause 3 to include notification to union committees of wage adjustments.

4. Restoration of wage cuts and no further wage cuts or hour increases in the plant. A flat 36-hour week and six-hour day.

5. A policy of straight seniority throughout the plant, including flying squadron members as well as other employees.

6. Termination of company financial assistance to Goodyear Industrial Assembly.

In a radio address over Akron's two stations Monday night, March 9, Mr. Litchfield outlined the company's peace proposal. He called upon strikers, non-strikers, citizens of Akron, and city and county officials to cooperate toward peace in this direction, calling attention to the fact that nearly 14,000 Goodyear non-striking workers wanted to resume their work. He cited the fact that the strike had cut off payrolls and taken more than $100,000 a day out of circulation in Akron.

Jan. Passenger Car Sales Near Peak of Jan. 1929

New passenger car sales in the United States during January totaled 215,782 units, based on official registrations for the nation compiled by R. L. Polk & Company. This figure for January has been only once exceeded in the history of the industry, in 1929 when the first month's total was slightly larger at 219,760 units.

The January, 1936, total represented an increase of 57.9 per cent over the 136,635 units registered in January a year earlier, and a decrease of 9.03 per cent from 237,194 in December, 1935.

Position of the Sales Engineer

His functions and value are debated at an S.A.E. meeting in New York

Some buyers think all elephants are pink because they once saw one that color. This is only one of the many problems that must be met by the competent sales engineer, according to T. L. Preble, Tide Water Oil Co., who injected the point into discussion at the Metropolitan Section meeting of the Society of Automotive Engineers on March 9, when "Sales Engineering" was the subject.

The sales engineer as counselor and helper of the customer was a common topic of two papers by Stephen Johnson, Jr., chief engineer, Bendix-Westinghouse Automotive Brake Co., and Richard H. DeMott, general sales manager, S. K. F. Industries, Inc.

Speaking from the viewpoint of company headquarters, Mr. Johnson pointed out the technical qualifications of the able sales engineer which include such points as a thorough knowledge of his product both from the standpoint of design and its application and limitations in the field. Mr. DeMott, taking the customer's side of the picture, showed how the sales engineer might assist in the development of the customer's ultimate product from the time of its first conception on the drafting board. For here the sales engineer can see the application of his product and can suggest changes in design, either of the customer's product or his own, which might better the performance that is expected of the final design.

The question of the salesman's right to suggest such a change in his own product brought some discussion. For Mr. Johnson (as the home engineer) questioned the advisability of the salesman's asking for change in design to meet specific needs. According to this speaker the salesmen should venture an opinion on design only after due consideration and surety that facts were at hand.

But J. D. Williamson, district sales manager of S. K. F. pointed out the value of the sales engineer's experience and advice and suggested that it be welcomed at the home office, even if his observations were inclined more toward opinion than fact.

All agreed, however, to the careful use of facts. Nothing can bring on the disfavor of a customer more quickly

or more completely than misstatement or misuse of facts. All should be accurate and should be used only with the permission of the customer. And this use of facts applies in communications with the home office as well as the customer. For, said Mr. Johnson, it is better not to be understood at all than to be misunderstood.

Further reference to contact with the home office was brought out in a remark by Mr. Williamson on a sense of humor. Though Mr. Johnson had ably set forth the fundamentals of a good salesman, he had left out a sense of humor. And this, said Mr. Williamson, was often more valuable in contacts with the home office than with the customer.

Both Mr. Williamson and Mr. Preble commented on the value of a salesman (and this time it was just a plain salesman as well as an engineering salesman) as a fact-finder. On several occasions incidents were cited of salesmen whose approach was fact-finding rather than straight selling and the resulting advantage of this approach.

Virtually all who spoke, and this included, beside those already mentioned, T. C. Smith of American Telephone and Telegraph; Austin M. Wolf, consulting engineer; J. F. Winchester, Standard Oil of New Jersey, and meeting chairman M. C. Horine of Mack International Motor Truck Corp., agreed that in service lay the most potent sales approach. For performance in the field, maintained by the service manager, the sales engineer, or whatever he might be called, was the trump card of any manufacturing company.

E. R. Gurney summed up the ultimate purpose of the sales engineer as the connecting link between the manufacturer and his industrial customer, for through him the products of both buyer and seller may be coordinated to function at maximum efficiency.

Howard L. Spohn

Howard L. Spohn

Howard L. Spohn, account executive of the Gardner Advertising Co., New York, died in Lansing, Mich., on March 6, at the age of 55 years.

Mr. Spohn was widely known in the automotive industry through his association with it during 28 years in advertising, manufacturing and sales capacities. He was with the Class Journal Co. for 12 years as general field representative. During the war he directed sales of the U. S. Ball Bearing Co., and after the armistice returned to work with the Class Journal Co. until 1920.

Since that time, Mr. Spohn was engaged in advertising work. He joined the Gardner Advertising Co. in 1924, in charge of the newly opened Chicago office, and was with that company until his death, except for a brief absence, when he was associated with the McGraw-Hill Publishing Co.

Goudard, French S.I.A. Pres., to Visit This Country in May

M. Maurice Goudard, president of the Société des Ingénieurs de l'Automobile, and the Solex Carburetor Company, left Paris the week of March 3 on a journey to Japan and the United States. Reaching Japan at the beginning of April, M. Goudard will examine the budding Japanese automobile industry.

He expect to reach San Francisco between May 10 and 15, and to return to Paris by the middle of June.

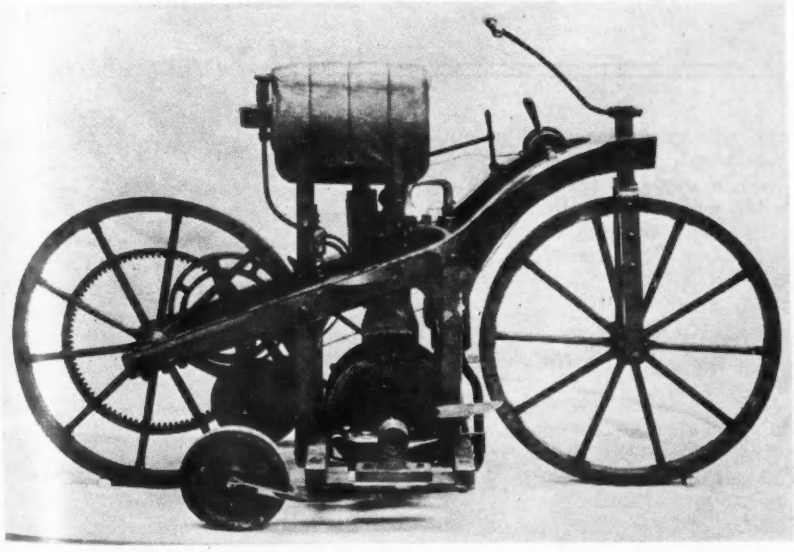
A.M.A. Member Production Lower in February, but Equal to Year Ago

The February output of members of the Automobile Manufacturers Association was placed at 218,270 units in the preliminary estimate announced this week by the association.

On the basis of this estimate, February production represented a decrease of 21 per cent under the preceding month and 1 per cent under February, 1935.

The output for Association members for the first two months of this year was 494,715 units, an increase of 17 per cent over the same period for the previous year. The report, which covers the operations of all but one of the major producers of motor vehicles in the United States, is summarized below:

February, 1936	218,270
January, 1936	276,445
February, 1935	220,162
2 months, 1936	494,715
2 months, 1935	424,177



Fifty years ago, the first German patent was granted Gottfried Daimler for the motor vehicle shown above.

New Foundry Unit Opened by Makers of Lektrokast

Detroit Gray Iron Foundry Co. announces the opening a complete new foundry unit for the production of Lektrokast—trade-name for their new electric furnace iron. The furnace is housed in a new building of approximately 15,000 sq. ft. of floor space which will be formally opened with an afternoon inspection for the trade on March 14, when a demonstration of the process will be given guests. Advantages of Lektrokast, according to Hugh Martin, president, is finer grain, closer texture and higher tensile strength, "which make it fill a place by itself in the finest type of die construction."

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

Business activity rose last week, mostly as a consequence of greater steel production and increased car loadings. Railway freight loadings, stimulated by shipments postponed during the adverse weather, were the highest since last October. Another encouraging item in current business reports is that construction contracts awarded in February were 142 per cent above those in the corresponding period last year.

Good Weather Lifts Carloadings

Railway freight loadings during the week ended Feb. 29 amounted to 673,123 cars, which marks an increase of 86,411 cars above those during the preceding week, a rise of 68,792 cars above those a year ago, and an increase of 67,406 cars above those two years ago.

Food Prices Decline Slightly

Retail food costs during the two weeks ended Feb. 11, according to the Bureau of Labor Statistics, moved moderately downward. The index on that date stood at 80.6, as against 80.7 two weeks earlier and 102.3 in February, 1929.

Electricity Continues Higher than Year Ago

Production of electricity by the electric light and power industry in the United States during the week ended Feb. 29 was 9.7 per cent above that in the corresponding period last year.

Lumber Production Steady

Lumber production during the week ended Feb. 22 amounted to 50 per cent of the 1929 weekly average, and shipments were 58 per cent of the 1929 average. Shipments, production, and new business during the week under discussion were all less than 6 per cent below the figures for the preceding week, which, however, contained no holiday.

Farm Prices Unchanged

The farm price index compiled by the Bureau of Agricultural Economics stood at 109 on Feb. 15, which was the same as that two weeks earlier and two points below that for a year ago. Prices paid by farmers for the commodities that they purchase were also unchanged, but the average was five points lower than that for a year ago.

Petroleum Output Firm

Average daily crude oil production for the week ended Feb. 29 amounted to 2,774,700 bbl., as against 2,779,200 bbl. for the preceding week and 2,473,850 bbl. a year ago.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended March 7 stood at 82.8, the lowest level since last July, as against 83.3 the week before and 83.8 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve Banks for the week ended March 4 showed a decline of $1,000,000 in holdings of discounted bills and an increase of $1,000,000 in Government securities. Holdings of bills bought in the open market remain unchanged. Money in circulation rose $73,000,000, and the monetary gold stock increased $4,000,000.

A.M.A. Investigates Strength of State Dealer Associations

Realizing that some of the automotive industry's most important legislative battles will be fought in state legislatures, and that dealers themselves are best qualified to represent the industry in their own states, motor car manufacturers are investigating the state dealer associations in order to find out which are in need of further strengthening, and to get state associations formed where none exist at present.

A representative of the Automobile Manufacturers Association has recently visited a number of state dealer association managers in this connection. The study being made by the manufacturers will require several months, it is understood, and meanwhile no decision will be made by the A. M. A. as to possible action, other than what it is already doing through the National Highway Users Conference.

British Manufacturers Limit Publicity of Contest Results

Striking at unauthorized speed trials, races and so-called motor rallies, which have furnished the basis for widespread performance advertising by members of the automobile trade in Great Britain, the Society of Motor Manufacturers and Traders has placed definite restrictions on the employment of such advertising, according to a report received by the Bureau of Foreign and Domestic Commerce, Washington.

The recently announced decision, places a definite ban on performances not specifically approved or announced by the society. No ban on participation in any race or speed event exists, but the results must not be advertised. The observance of these and other restrictions are insured by the signing of a bond by each member of the society, the bonds covering not only the members but their distributors and dealers.

New Model Development Described by Geschelin

On March 9, Joseph Geschelin, Detroit technical editor, AUTOMOTIVE INDUSTRIES, addressed the Cleveland Section, S.A.E., on the general subject of the development of new models in the automobile industry. His paper emphasized the contributions of the parts makers, suppliers and machinery designers in the development of new ideas in design and constant improvement in manufacturing costs and quality.

The paper was illustrated by views taken in various automobile plants during the early part of this season.

$1,000,000 Worth of Trucks, Equipment Ordered by C.C.C.

More than $1,000,000 worth of trucks and other heavy equipment for use by the Civilian Conservation Corps were ordered during January and February, according to an announcement by Robert Fechner, director of emergency conservation work.

Truck purchases amounted to 473, valued at $458,972, and 45 tractors of various types, costing $133,259 in all, were bought. The balance of the purchases were plows, graders, power shovels, and other machinery needed in the conduct of the C. C. C. work programs.

40 Years Ago

—with the ancestors of AUTOMOTIVE INDUSTRIES

The motor truck problem presents some special difficulties not met with in lighter vehicles. Some experimenters are endeavoring to apply the power to each wheel, but this introduces complications in steering.

The steering of a heavy motor wagon is in itself no easy task. Great leverage is needed to move the wheels under a load, and at the same time the shocks and jerks of the road must not cause the motorman to lose control of the lever.

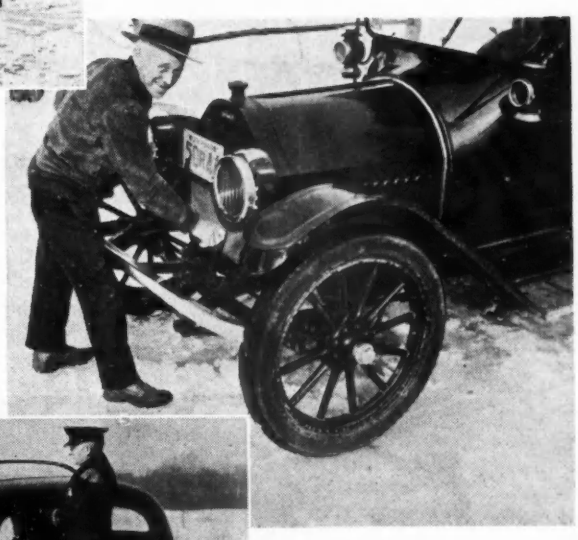
Perhaps it may be found desirable to put the load well to the rear, and thus relieve the forward trucks of most of their weight. — From *The Horseless Age*, March, 1896.

(Above) New Japanese Army motorized unit, one of the first completely built in Japan, on winter maneuvers. Copies of this picture were seized and suppressed by the Japanese censor.

The WORLD on WHEELS

(Above) Emperor Henry Pu-Yi's Packard waits before a Manchukuo government building in Hsinking

(Below) Hiram H. Dohner, of Quentin, Pa., and his 1913 Chevrolet, the oldest one licensed and in regular use. The Chevrolet Motor Co. will give Mr. Dohner a new 1936 model, the millionth car built by the company.



(Left) New type of illuminated speed-limit sign which is being installed on British highways.

(Left) A five-foot U-shaped metal bar, attached at both ends by bakelite supports, has been designed by Oldsmobile engineers as a special antenna to secure the best possible radio reception on police cars.

European, International and Wide World photos.

March Sales Spurt; Drain Field Stocks

(Continued from page 387)

turned out in the last half of March.

The country-wide pick-up in sales now has pretty well established that the recent slump was due entirely to weather conditions. There had been some skepticism when it was noted early in the year that the extreme South for a time also showed a shrinkage in demand. While free of snow and ice, the weather apparently had been unseasonable enough to influence the automobile market, since these sections are paralleling the North in the sales upswing now under way.

It is estimated that retail deliveries of passenger cars last month totaled 180,000 and truck deliveries 43,000, an aggregate of 223,000 vehicles, which is only 9 per cent below the January volume of 244,000 units. Despite the eleventh-hour improvement that set in, sales did not attain the level of February last year, when 235,000 cars and trucks were delivered. Weather conditions a year ago were more favorable and the month enjoyed the fresh stimulus of automobile shows still in progress.

Report of the Automobile Manufacturers' Association showing production by members last month of 218,270 cars and trucks confirms the revised February estimate of around 300,000 units for the industry as a whole. This compares with 380,954 units in January and 353,781 in February, 1935. It brings production for the first two months this year to 680,000 cars and trucks and leaves 428,000 units to be produced in March, if the industry is to match the first quarter's output last year.

Chevrolet

Chevrolet reports February retail sales of 70,087 cars and trucks, bringing the total for the first two months to 145,789 units—a new record for such period . . . February used car sales increased 65,000 over February, 1935 to 149,698, a new high mark for that month . . . Total used car sales during the first two months this year were 316,662.

Buick

Domestic retail deliveries of Buick cars during the first two months of 1936 totaled 13,647 units, the best for this period since 1929, and a gain of 79 per cent over like period last year . . . January sales were 7066 units against 3870 in January, 1935 while Feburary deliveries of 6581 cars compared with 3747 a year ago.

Pontiac

Retail deliveries of Pontiacs in February were 8515 of which 3809 were delivered in the last nine days.

Goodyear Decision

(Continued from page 387)

port, was the secrecy of Goodyear's bonus contract negotiated with Sears in 1931 which called for a cash payment to Sears of $800,000 plus 18,000 shares of Goodyear stock then valued at $450,000. The bonus was supplementary to the cost-plus contract and had the effect of cutting the terms of the contract to cost plus 4 per cent.

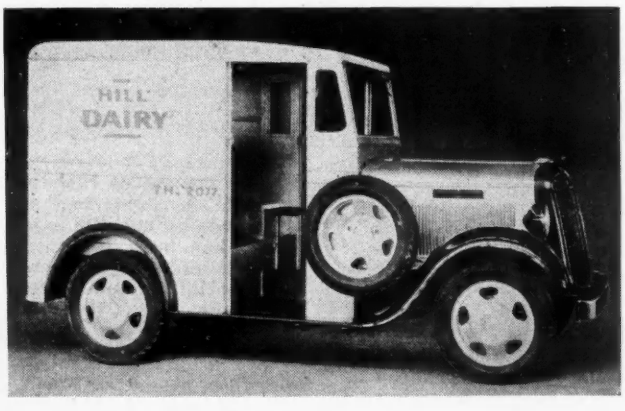
As evidence of the effect of Goodyear-Sears contract, it was stated in the proceedings that many thousands of independent tire dealers had been driven out of business and that during the time the contract has been in force, the total number of tire manufacturers had declined from 114 to less than 20.

In its ruling the commission allowed Goodyear 30 days to file a report on the manner in which the provisions of the order will be met. Owing to present low profit margins, it is not expected that Goodyear will lower its prices to independents and will therefore be required to raise its contract with Sears to cost plus approximately 18 per cent.

The Goodyear-Sears contract, regarded as the first of its kind of major importance, has been the pattern for many similar negotiations. Among many large manufacturers and distributors who are studying the order with intense interest is the United States Rubber Co. which supplies tires to Montgomery Ward, and which, together with the B. F. Goodrich Co., produces tires for various Standard Oil units.

Studebaker Franchises Signed With 56 Dealers in February

February sub-zero weather did not halt Studebaker's campaign to strengthen its dealer organization. Fifty-six new franchises were granted. These were in 57 cities in 25 states.



Dodge's 1936 "Stop-Go" truck for milk delivery. The curb-high floor and stool-like driver's seat make easier the milkman's task.

H. J. CARMICHAEL became vice-president and general manager of General Motors of Canada, Ltd., on March 1, succeeding H. A. Brown, who resigned.

T. R. STENBERG has been appointed chief engineer of the Marshall Asbestos Co., of Troy, N. Y., manufacturers of Eclipse brake lining.

M. ROGERS has been named general factory manager of Caterpillar Tractor Co. Mr. Rogers entered the tractor industry in 1922 as foreman with the C. L. Best Tractor Co., one of the predecessors of Caterpillar. He has since been assistant factory manager at the Peoria plant, and later factory manager.

JAMES R. MUNRO, formerly superintendent of the Diesel engine assembly line and assistant superintendent of tractor erection, has been promoted factory manager of the tractor division, Caterpillar Tractor Co.

L. J. HARTNETT, regional manager for Australia and New Zealand of General Motors Export, has arrived for a visit of two weeks at the home office in New York.

TOM O. DUGGAN, merchandising director with Thompson Products, Inc., since 1931, has been promoted to the position of general manager of the service division.

ARNON N. BENSON, executive secretary of the Minnesota Automobile Dealers Association for the past 12 years, has resigned to become affiliated with the National Automobile Dealers Association in an executive capacity.

JOHN W. BLACKFORD, for many years associated with the ball bearing division of the Torrington Co., Torrington, Conn., as factory salesman and Detroit district manager, has joined the sales organization of L. C. Biglow and Co., Inc., manufacturers' sales agents, 250 West 54th Street, New York City, where he will have charge of the bearings department.

HARRY L. BILL, a veteran of 20 years in the automotive industry, has joined the executive staff of the Bendix Aviation Corp., and will make his headquarters with the Pioneer Instrument Co., Inc., Brooklyn, N. Y.

RICHARD G. HUDSON has been named manager of the Studebaker Corp. truck division to succeed W. Howard Edwards, resigned.

C. S. FLETCHER has been appointed sales promotion manager of Studebaker's passenger car and truck division.

Combats Carbon Monoxide

New Compound, Discovered in Paris, Neutralizes Toxic Exhaust Gases

Under the name of "Oxycarbozone," Professor Royer, of Paris, has produced a new gas which he claims will completely neutralize the effects of toxic gases. The main uses for this gas lying in its possibilities for counter-gas warfare, it is supplied in the form of a fine powder to be distributed in the air through a pulverizer. Professor Royer describes this gas as a new form of solidified and superactive oxygen.

As a demonstration of its efficacy, rats and other small animals were almost completely asphyxiated by toxic gases and immediately revived by Oxycarbozone being blown into their chamber.

The gas is claimed to be completely effective against carbon monoxide, the method of utilization being a special exhaust box containing a quantity of Oxycarbozone which neutralizes the exhaust gases, rendering them inoffensive. The exhaust chamber needs to be refilled with Oxycarbozone at rather frequent intervals.

Stock Car Classic Cut Short by Tide

Milt Marion Takes Honors in Daytona Beach-Road Race; Speed Is 47.8 MPH

Special to AUTOMOTIVE INDUSTRIES

Cut short at its two hundred and forty-first mile by an incoming ocean tide, the first annual beach and road race classic at Daytona Beach on March 8 was halted with Milt Marion in the lead, a full three and one-fifth mile lap ahead of his nearest rival, Tommy Elmore. Third, fourth and fifth places were taken respectively by Ben Shaw, Sam Purvis and Bill France. Out of the 27 starters, three favorites, Bill Cummings, George "Doc" MacKenzie and Major Goldie Gardner of England, were forced out by mechanical trouble.

The first five, as well as eight out of the ten cars which finished, were Ford V-8's which, like all cars in the race, were limited to strictly stock equipment in every detail and were checked by the contest board of the American Automobile Club.

The course, which included Daytona's famous measured mile and also a portion of the Ocean Shore Boulevard which adjoins, offered severe handicaps on the improvised turns, and winning time was held down to 47.8 miles per hour.

Packard Plans

(Continued from page 387)

reasons that Packard no doubt is in the process of bringing out a car in the lower price field to round out its line, and is looking for the new offering to make its bow at the New York automobile show next fall—in other words, that the company is aiming at the 1937 market.

Obviously at this stage, only guesses can be made as to the price. Consensus of speculation places it about midway between the Packard 120 and the low-priced volume makes.

The 1936 Year Book of the **Tire and Rim Association**, Inc., containing standards and recommended practice on all types of tires, rims, and related equipment, has just appeared. Copies are $2, from the office of the Association in Cleveland.

Supplement of May, 1935 List of Inspected **Electrical Appliances.** — Underwriters Laboratories, Chicago, Ill.

Symposium on **Spectographic Analysis**, a reprint of six papers dealing with different phases of the subject.—American Society for Testing Materials, Philadelphia, Pa.

Gear Grinding is the title of the latest circular, No. 420, of Pratt & Whitney Co., Hartford, Conn.

The Brown Instrument Co., Philadelphia, Pa., has issued a folder which describes the features of Brown **air operated controllers**, recently introduced by this company.

Bus-Rail Interests Form New Group

(Continued from page 387)

and general manager, Santa Fe Trails System; P. J. Noff, vice-president and general manager, Missouri Pacific Transportation Co.; Paul O. Dittmar, president, Safeway Lines, and Frank Martz, treasurer and general manager, Frank Martz Coach Co.

The association has established headquarters in Chicago.

With the announcement of the new association, Mr. Stewart declared that among the first functions of the body will be the consolidation and improvement of terminal facilities. Strict and constant supervision of new equipment will also be maintained, he stated.

The association is said to have adopted a standard of streamlined units, several hundred of which are already in operation. Others will be purchased within a few weeks to replace the old equipment.

Hercules Expands to Step Up New Small Diesel Production

An expansion program designed to increase facilities for the production of gasoline and Diesel engines is nearing completion at Hercules Motors Corp., Canton, Ohio. When completed, the Canton plant will have an addition of 70,000 sq. ft. of floor space, of which a small portion will be for a new office building. This plant addition does not include the Muskegon plant recently placed in operation.

Plans have been completed for the production of the small Hercules Diesel engine at the rate of 50 per day. Jigs and fixtures are ready and will go to work just as soon as the plant addition is completed. According to the company there is a heavy demand for the small Diesel, not only for domestic use but for export. Hercules expects to produce from 4500 to 5000 of these engines during 1936.

Labor Split Patched

(Continued from page 387)

L. executive council's decision to terminate its probationary period of control over the international union. The fact that the official call was signed by both Dillon and Hall indicates that the differences existing between factions in the union headed by these officials have been composed, at least temporarily.

Ed Hall and Homer Martin, general vice-president, last month had set up separate headquarters and refused to cooperate with Dillon, but after a conference with Green in Washington, returned to Detroit to cooperate in arrangements for the convention.

The Workers Education Bureau of America, under the supervision of Dr. Paul L. Vogt, in cooperation with the local committee, will conduct a series of programs during the convention sessions which will be addressed by outstanding educators, economists and labor leaders.

Tuthill Spring Co. Directors Name H. T. Moore President

At a special meeting of the board of directors of the Tuthill Spring Co., Chicago, H. T. Moore was elected president, succeeding Frank H. Tuthill, deceased. Mr. Moore has been with the Tuthill Spring Co. for nearly 20 years, having been vice-president for the last five years. W. S. Van Bergen was elected vice-president in charge of production, J. H. Schmidt was elected secretary and O. C. Nuss remains as treasurer.

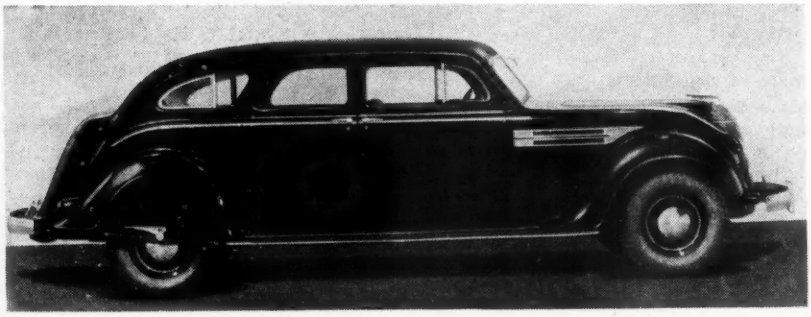
Alfred Owen Dunk

Alfred Owen Dunk of Grosse Point Farms, Mich., pioneer in the automobile industry, died March 5 of pneumonia at Los Angeles while on a business trip. Mr. Dunk was formerly president of the Detroit Electric Car Co.

Earnings Statements of Automotive Companies

	1935	1934
Bohn Aluminum & Brass Corp.	$1,588,827	1,518,388
Borg-Warner Corp.	†6,982,732	3,750,576
Consolidated Aircraft Corp.	322,731	6,560
Consolidated Oil Corp.	11,306,904	553,281
Fisk Rubber Corp.	*274,775	728,697
Martin (Glenn L.) Co.	*318,364	*59,849
McQuay-Norris Mfg. Co.	463,582	478,580
National Automotive Fibres, Inc.	850,356	448,987
Wilcox-Rich Corp.	956,155	548,461

* Net loss. † Preliminary.



Chrysler announces two new body styles in its Airflow Custom Imperial line, a six-passenger sedan and an eight-passenger sedan limousine (shown above). Both are built on a 137-in. chassis. The sedan is priced at $2475 and the sedan-limousine, $2575.

Liquefied-Gas Fuels

(*Continued from page 388*)

Further tests on the CFR engine showed that when the compression ratio of the engine was increased from 5:1 to 10:1, with the liquefied gas as fuel, the power output was increased 44 per cent and the maximum combustion pressure increased from 375 to 725 lb. per sq. in.

Charles Guernsey, J. G. Brill Co., mentioned that one of his company's 300-hp. gasoline engines on the Pacific Coast had been converted to the use of distillate. The regular rating of the engine on gasoline was 300 hp. and it was capable of giving a maximum of 340 hp. On distillate the output was only 275 hp. and in operation it was quite troublesome. It was then decided to convert the engine to the use of liquefied gases, and to this end the compression ratio was raised to 6.5 to 1. The engine then delivered 425 hp. without trouble.

As regards the future of the Diesel engine, Mr. Clayden was less optimistic. His principal objection to that engine was its sensitiveness to fuel characteristics. The fuel required for Diesel engines was of the same general character as that used in domestic heating plants, and if Diesels were developed that would operate satisfactorily on all fuels that could be used in such heating plants it would be all right. Some of the engines, of course, gave very satisfactory results on a comparatively wide range of fuels, but not all. As regards automotive fuels, the tendency had been toward higher and higher octane ratings, to permit of the use of higher compressions. This could be met either by the use of more products of the cracking still or by the addition of small quantities of chemical dope. But the same expedients which improved the octane value of fuels for spark-ignition engines tended to reduce the cetane value of Diesel engine fuels, and the petroleum industry would have a difficult time trying to produce acceptable gasolines and Diesel fuels by the same process.

Mr. Clayden in his talk also referred to the low thermal efficiency of the modern automobile. Twenty years ago this low efficiency could be explained by the poor quality of the gasoline, judged by present-day standards. About a decade ago the petroleum industry had succeeded in producing gasolines that would have permitted of important increases in the economy of operation, but the automobile industry, instead of improving the economy of their cars, took advantage of the improvement in fuels to increase the performance of the cars. The speaker said gasoline economy would become increasingly more important because of the rising taxes on gasoline. Car manufacturers realized this and were working toward greater fuel economy at the present time. One large manufacturer, he said, was planning to double present fuel mileage, while another was planning to guarantee a fuel mileage of 30 per gal. next year. Mr. Clayden did not divulge how these high fuel economies were to be obtained, but he hinted that no sacrifice in performance was contemplated.

In the discussion, Mr. Clayden explained that for the transportation of propane, tanks must be used which will safely withstand pressures of 200 lb. per sq. in. The cause behind the original development of the liquefied-gases motor fuel scheme on the Pacific Coast was that there was a glut of these gases and that they were not subject to the fuel tax. Taxation of the fuel when used in road vehicles was, of course, inevitable.

Harry F. Huf of the Atlantic Refining Co. took a rather optimistic view of the future of the Diesel engine. He

World Production of Motor Vehicles

(Revised)

	1933*			1934*			1935**		
	Passenger Cars	Trucks & Buses	Total	Passenger Cars	Trucks & Buses	Total	Passenger Cars	Trucks & Buses	Total
United States	1,573,512	346,545	1,920,057	2,177,919	575,192	2,753,111	3,285,836	723,660	4,009,496
Canada	53,855	12,069	65,924	92,647	24,205	116,852	139,742	33,253	172,995
Total	1,627,367	358,614	1,985,981	2,270,566	599,397	2,869,963	3,425,578	756,913	4,182,491
Austria	1,150	425	1,575	975	380	1,355	e1,000	e300	e1,300
Belgium	800	600	1,400	500	240	740	e500	e300	e800
Czechoslovakia	8,670	1,330	10,000	9,110	890	10,000	9,000	1,000	10,000
Denmark	.....	140	140	.....	182	182	.....	.....	‡
France	163,770	28,159	191,929	172,328	29,316	201,644	151,801	26,000	177,801
Germany	92,610	13,222	105,832	147,330	25,684	173,014	185,000	43,000	228,000
Hungary	.....	143	143	19	203	222	.....	.....	‡
Italy	32,000	10,000	42,000	38,907	4,509	43,416	e36,000	e12,000	e48,000
Japan	191	1,617	1,808	930	1,915	2,845	2,000	500	2,500
Poland	780	(1)	780	200	600	800	.....	.....	‡
Soviet Russia	10,252	39,491	49,743	17,100	55,366	72,466	19,000	77,700	96,700
Spain	80	295	375	100	730	830	.....	.....	e800
Sweden	700	2,275	2,975	600	2,522	3,122	.....	.....	e3,550
Switzerland	.....	480	480	16	420	436	.....	400	400
United Kingdom	216,149	64,377	280,526	264,957	82,899	347,856	†311,544	†92,176	†403,720
Total	527,152	162,554	689,706	653,072	205,856	858,928	715,845	253,376	973,571
World Total	2,154,519	521,168	2,675,687	2,923,638	805,253	3,728,891	4,141,423	1,101,289	5,156,062

* Bureau of Foreign and Domestic Commerce—Automotive Division.
** The American Automobile (Overseas Edition)
(1) Included with passenger cars.
‡ Estimated 1,500 more vehicles produced in these three countries combined.
† For final year ending September 30, 1935.
e Partly estimated.

made the statement that the fact the Diesel engine called for a change in the marketing system of petroleum products would not rule it out. There was a great surplus of liquefiable gases at this time, but as far as propane was concerned that would be taken care of by the polymerization process which was now under development.

METALS..

Price Cuts for Quantity Spread to Sheet Steels

Quantity discounts, ranging from $1 to $3 a ton, the latter figure applying to 150 ton orders, were announced by one of the large "independents" on Tuesday, when that producer made public second quarter base prices for sheets. Base prices were virtually left unchanged from those that were nominally in effect during the first quarter, but concessions from which have lately ranged at from $3 per ton upwards. The quantity discounts are restricted to releases for shipment of the tonnage at one time.

Application of quantity differentials, as a means of stabilizing the market, had been under consideration for a long time and large automotive consumers were sounded with regard to the proposed move. Such differentials have been in vogue in the market for hot rolled bars since October, but are an innovation in that for flat steel. It is expected that strip prices will be subject to a similar set of quantity differentials.

Considerable protective buying of both sheets and strip steel by automotive consumers, especially by parts makers, was reported previous to announcement of the new price set-up. Buying of hot and cold rolled strip was especially heavy. Finishing mills in the Detroit and Cleveland areas, that a fortnight ago complained of dwindling specifications, have received sufficient additions to backlogs in the last few days to bring capacity operating rates once more into sight.

Automotive buyers had been aware for a long time that the ragged condition of the market would sooner or later result in attempts on the part of sellers to correct this condition. Steel producers let it be understood that they did not so much want to lift prices as to stop further inroads on quotations, which in some cases suffered in actual sales to the extent of $5 a ton. Consumers, no less so than producers, recognize that regardless of what method of pricing steel is followed, competitive conditions will determine the market. Automotive consumers are reported to be fairly well covered for their nearby needs at old prices. The test will come when late April and May requirements call for covering. Revamping of wire prices resulted in a $2 per ton advance in the price for bright manufacturing wire, while some other wire products were marked down.

Pig Iron—As the second quarter draws nearer, automotive foundries show more interest, but so far, few representative transactions are being consummated. Prices are unchanged.

Aluminum—Routine conditions prevail.

Copper—Better export demand has heightened the impression that the domestic market will before long be on the 9½ cent basis, now quoted by one set of producers, while others continued to sell at 9¼ cents early this week. It is pointed out, however, that most of the 9½ cents sales are to fabricating subsidiaries of the sellers.

Tin—Slightly lower Sterling exchange caused the price of spot Straits to recede from 48.50 to 48.30 cents at the week's opening. British tin market commentators blame Bolivian producers for having brought about a curtailment of production quotas. Bolivia is a high cost producer. The British fear that, if pressed too hard, the South Americans might ship their ores to the United States where smelters would be erected to compete with the British and Dutch.

Lead—Firm.

Zinc—Latest statistics feature reduction in smelters' stocks. The market shows a stronger undertone.

Funds Granted for Testing Cotton in Highway Building

The use of Government funds for the purpose of stimulating field tests of new uses of cotton in highway construction has been approved by Henry A. Wallace, Secretary of Agriculture, according to an announcement by the Agricultural Adjustment Administration this week.

The project provides for the diversion of manufactured cotton fabric for use as a reinforcement membrane in bituminous surface-treated highways and for cotton mats for use in curing concrete highways. If the results of these tests are as favorable as certain preliminary trials along these lines have indicated, these new fields of use would require large quantities of cotton in the future.

Repair Shop Union Formed in New York

United Vehicle Workers of U. S. Aims to Better Shop Wage-Hour Standards

Conflicting views as to the degree of success already obtained and as to the future plans of the United Vehicle Workers of the United States, are expressed in trade quarters in New York.

Counsel for the union, Bernard Lieberman, stated to AUTOMOTIVE INDUSTRIES that the objectives of the union are to better service and repair working conditions and that private surveys made indicate that low rates of pay in some quarters are the basis for the drive. He said that the cost of materials and general overhead costs of repair shops are about the same and that an effort will be made to secure a uniform scale of wages in order to prevent both exploitation of labor and undercutting of prices for work done. The two are interlocking factors to some extent.

Whether the union will eventually become affiliated with the American Federation of Labor is not known as yet, but some steps are authoritatively reported to have been taken in that direction. In other trade quarters, it is reported that the union will have nothing to do with the Federation. Its future plans are also clouded with uncertainty. There is some reason to believe, say close observers, that the union will seek to spread into the manufacturing areas and not confine itself to service and repair.

The New York president of the union is Charles Bottinger, said to be a mechanic of 30 years' experience with wide trade contacts. The New Jersey chairman is Joseph Preml.

CALENDAR OF COMING EVENTS

SHOWS

Switzerland, Automobile Show, Geneva, March 20-29

Hungary, Automobile Show, Budapest, Mar.-April

Illinois Automotive Parts Assoc., Maintenance Exhibit, Navy Pier, Chicago, April 4-8

Portugal, Automobile Show, Lisbon, begins April 16

Yugoslavia, Automobile Show, Zagreb, May 2-11

Foundry and Allied Industries Exposition, Detroit .....May 4-9

Spain, Automobile Show, Madrid, May 10-20

International Petroleumn Exposition, Tulsa, Okla. .....May 16-23

Morocco, Fair of Tangiers.....May 16-24

Yugoslavia, 16th International Spring Fair, Lubliana.....May 30-June 11

France, Automobile Exhibit at Foire de Paris .....May

Norway, Automobile Show, Oslo.....May

Olympia Motor Show, London, England, Oct. 15-24

CONVENTIONS AND MEETINGS

American Chemical Society, 91st Annual Meeting, Kansas City, Mo....April 13-17

S.A.E. Tractor and Industrial Power Meeting, Milwaukee, Wis...April 15-16

American Gear Manufacturers Association, Twentieth Annual Convention, Philadelphia.....April 20-21

S.A.E. Production Meeting, Detroit, Mich. .....April 21-24

U. S. Chamber of Commerce, Annual Meeting, Washington .....April 27-30

American Foundrymen's Association 40th Annual Convention, Detroit, May 4-9

American Petroleum Institute Mid-Year Meeting, Tulsa, Okla..May 13-15

National Battery Manufacturers Association, Spring Convention, Cleveland .....May 20-21

S.A.E. Summer Meeting, White Sulphur Springs, W. Va. .....May 31-June 6

Automotive Engine Rebuilders Assoc. Annual Convention, Cincinnati, June 1-4

American Society for Testing Materials, Annual Meeting, Atlantic City, June 29-July 3

American Society for Metals, 18th Nat'l Congress, Cleveland, O.....Oct. 19-23

Engines on the Spot...

Cathode - Ray Oscillograph developed by R.C.A. bares powerplant secrets and brings out the truth about vibration, noise and cylinder phenomena.

By P. M. Heldt

R. C. A. MANUFACTURING CO., INC., Camden, N. J., has developed a cathode-ray oscillograph with a piezo-electric detector or pick-up device, which is adapted for investigations on engine-cylinder phenomena, vibration and noise. An oscillograph is essentially a device which traces a curve of an electric voltage applied to its terminals. If a study is to be made of the variations of, say, the pressure in the cylinder of an internal-combustion engine, then a device must be provided which will generate an electric voltage in proportion to the pressure, and electrical connections must be made from this detector or pick-up device to the oscillograph, generally through an amplifier.

The principal part of the R.C.A. oscillograph is the cathode-ray tube, of which a schematic sectional view is shown in Fig. 1. The "tube" comprises a glass envelope *E* from which the air has been exhausted. Within the small end of the tube there is a cathode *K* which when the tube is in operation gives off a stream of free electrons. To give off electrons, the cathode must be heated, and while in many electron tubes the filament through which the heating current is sent also forms the cathode, in this tube the cathode is separate from the heating filament and is therefore indirectly heated. The filament receives its current from a transformer connected across the alternating current service mains from which the whole instrument is operated. Between the cathode *K* and the anode *F* is located the usual grid *H* which serves to control the rate at which electrons are emitted by the hot cathode.

The electrons or electrically charged particles thrown off by the cathode when the tube is in operation, spread in the same manner as the rays from a source of light. In an optical system the rays may be condensed and focused by means of a system of lenses, and in the cathode-ray tube a similar effect is produced by the two anodes *F* and *A* which, as may be seen from the diagram, are of tubular form. These anodes condense the cathode rays and bring them to a focus on the screen at the far end of the tube. The condensing effect can be varied and the focus adjusted by changing the ratio of the voltages impressed on anodes *F* and *A* respectively. The voltage of *A* is normally held constant, while that of *F*, which is only about one-fifth as large, is adjusted until the rays are properly focused on the screen. Between cathode *K* and anode *A* a voltage of the order of 1000 must be maintained. The path of the rays from the cathode through the two anodes to the focus on the screen is shown in Fig. 2.

The rays thrown off by the cathode are not visible, but when they impinge upon the inner surface of the screen, which is coated with fluorescing or phosphorescing material, a spot of light is produced. It is this spot of light which is used to trace the curve of pressure variation, vibratory movement, or sound intensity that it is desired to study.

The beam of electrons in reality constitutes an electric current minus the usual metallic conductor, and is subjected to the same magnetic and electrostatic influences as a current-carrying conductor. In order to be able to trace a curve of pressure variations, for instance, the spot of light must have a dual motion. It must move horizontally in direct proportion to elapsed time, and it must move vertically in direct proportion to changes in pressure. To move the spot of light on the screen, the cathode-ray beam must be deflected from its normal direction. This can be accomplished by means of two sets of electro-static deflection plates *B* and *C* in Fig. 1. Plates *B* serve to deflect the beam horizontally, in proportion to time, and *C* to deflect it vertically, in proportion to pressure. It is therefore necessary to subject the two plates *B* to a potential difference which increases in direct proportion to time, and the

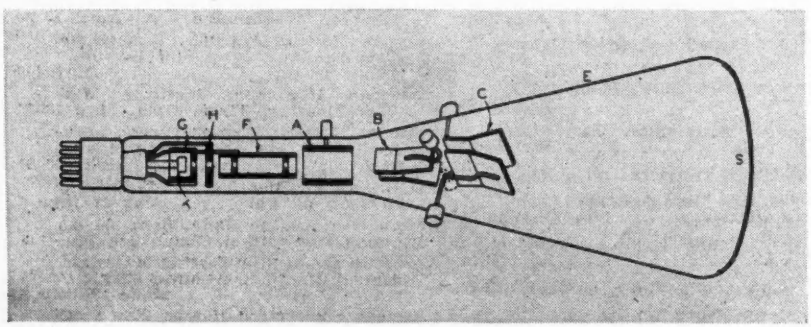


Fig. 1—Diagrammatic sectional view of R.C.A. cathode-ray tube

two plates C to a potential difference directly proportional to the phenomenon to be observed or recorded.

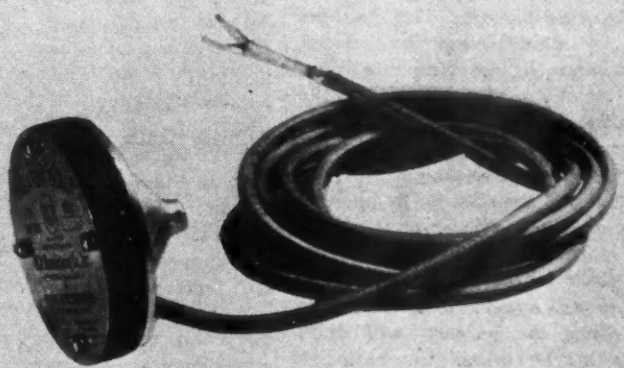
A typical oscillograph circuit is shown in Fig. 3. A d-c voltage, obtained from a-c service mains through a rectifier, is impressed on the terminals shown at the left. Immediately beyond these terminals the filter condenser C and the voltmeter V are connected across the d-c line. Beyond the points of connection of the voltmeter there is a bleeder potentiometer circuit comprising resistances R_1, R_2 and R_3, which pass from one to two milliamperes of current. One side of the d-c line is grounded (the upper one in the diagram), and from this side connection is made to anode No. 2, designated by A in Fig. 1. The cathode of the cathode-ray tube has a fixed connection on the potentiometer, so that the potential difference between the cathode and anode No. 2 always remains constant. On the other hand, the points of connection on the potentiometer for the grid and for anode No. 1 are movable, so that the voltage of the grid relative to the cathode and that of anode No. 1 relative to anode No. 2 can be varied. The filament of the tube has an independent supply of alternating current, obtained from the service mains through a transformer. Deflecting plates D_2 and D_4 are electrically connected to anode No. 2 inside the tube. Resistances R_4, equal to from one to ten megohms, are connected across the input circuits of the two pairs of deflecting plates. These resistances make it possible for the voltages of the two plates of a pair to become equalized rapidly when the outside source of voltage is removed. In the particular tube shown all connections are made through the base.

R. C. A. Manufacturing Co., Inc., manufactures cathode-ray tubes with electrostatic deflector plates, electromagnetic deflector coils, and also with one pair of plates and one pair of coils.

A potential difference or voltage increasing at a uniform rate is produced by the electric circuit illustrated diagrammatically in Fig. 4. A condenser C is connected in circuit with a current source B through a resistance R. Assuming the circuit to be open, there is no voltage on the condenser, and if the circuit is then closed, current from the source will flow into the condenser and charge it. As the condenser approaches a state of full charge, or, in other words, as the voltage of the condenser approaches that of the source of current, the current ebbs off and the rise in condenser voltage becomes slower and slower. Actually the voltage of the condenser follows an exponential curve, but as long as it is only a small fraction of that of the source, the rate of

The Oscillograph

and the pick-up device for vibration study



current flow, and therefore the rate of increase of condenser voltage, is substantially constant. In these oscillograph sets a charging voltage of 450 is used, while the condenser is charged to only 50 volts, and during the very short charging period the rate of condenser-voltage increase is constant to all intents and purposes.

After the condenser has been charged to about 50 volts, it is very rapidly discharged by means of the Type 885 tube, which is connected across it. When the voltage of the condenser (and therefore the voltage across the tube) reaches a certain value, the gases in the tube become ionized, the tube becomes conducting, and the condenser discharges through it. The exact voltage required is determined by the voltage applied to the grid of tube 885, which is varied by means of the potentiometer shown at the left in Fig. 4. The electrical assembly represented by Fig. 4 is referred to as a relaxation oscillator, or in shop parlance as a sawtooth wave generator. The voltage of condenser *C* increases uniformly with time, and after the critical voltage of the tube is reached it drops (non-uniformly) at a much more rapid rate. Thus by connecting plates *B* of the cathode-ray tube across condenser *C*, the spot of light can be made to sweep horizontally across the screen of the tube at a uniform velocity.

It should perhaps be pointed out that while the current sources in the various diagrams are represented as batteries, no batteries are used in the actual apparatus, all direct voltages required being obtained from a 110-volt, 60-cycle alternating current line by means of rectifiers and filters.

Instead of charging the sweep-circuit condenser through a resistance and using only a small fraction of the power voltage for the charge, so as to keep the condenser charging rate constant, a pentode tube may be included in the charging circuit. This has the property of maintaining the current flow (and hence the charging rate) constant up to about 85 per cent of the power voltage.

In observing recurrent phenomena, such as pressure cycles in gasoline engines, the usual practice is to operate the sweep-circuit oscillator at a simple fraction of the frequency of the phenomenon observed, so that several complete cycles will appear on the viewing screen. Since the pattern will drift across the screen unless the ratio of observed frequency to sweep frequency remains constant, it is usually desirable to synchronize the sweep-voltage oscillator. A few volts alternating current, adjustable from zero up and introduced into the grid circuit of the sweep-circuit tube, is suitable for the purpose. Where transient phenomena are under observation there is no need for any close adjustment of the sweep-circuit voltage, and synchronizing often is of no advantage. In some cases, however, if the curve of the transient is to be spread over practically the whole width of the screen, it is desirable that the phenomenon to be observed and the rise of the sweep voltage start simultaneously.

Two different kinds of phosphorescing coatings are used for the viewing screen, known as No. 1 and No. 5. The No. 1 has good visual and photographic properties as well as high luminous efficiency. The No. 5 is particularly adapted to moving film recording, as it has a short phosphorescent effect which prevents blurring of the image. For direct viewing, the No. 1 screen is preferable, owing to the greater persistence of the image. Where a stationary film is employed in making records of cathode-ray-tube patterns, good results may be obtained with the No. 1 screen.

The cathode-ray tubes are said to have a useful life of 1000 hours. The useful life of the tube usually comes to an end because the fluorescing coating of the screen loses its effectiveness. To prevent injury to this coating and preserve the tube, a small spot of high brilliancy should never be allowed to remain stationary on the screen for any length of time, as that would result in discoloring or burning of the particular spot on the screen.

The cathode-ray tubes are made in three sizes, of 3, 5 and 9-in. diameter. We understand that the largest size is still under development.

A photographic record of the phenomena on the viewing screen can be made with an ordinary camera. It is done preferably although not necessarily in subdued light, in order to obtain as much contrast as possible between the fluorescent pattern and the background. The camera must be firmly supported and sharply focused on the fluorescent pattern.

A number of different substances producing piezo-electric effects are known, including quartz, tourmaline and Rochelle salt. The last-mentioned is highly sensitive—about 7000 times more sensitive than quartz—and is usually employed where the pick-up device does not have to be exposed to high temperatures. For instance, the pick-up device illustrated, which is used in vibration studies, has two Rochelle salt crystals. For engine indicator work, quartz crystals are used in the pick-up device, the general construction of which is shown by the sectional view Fig. 5. The two quartz crystals are located in a metal tube between two metal electrodes, these electrodes being grounded to the shell of the pick-up device, which latter is screwed into a spark-plug hole, or if no extra spark-plug hole is available, into a special hole drilled through the engine head into the compression chamber. The gas pressure within the cylinder is communicated to the lower electrode, and through it to the crystals, through a diaphragm of stainless steel which closes the lower end of the tube containing the crystals. The two crystals are placed in the tube in the reverse direction with relation to their electrical axis, so that the adjacent faces, which are separated by a third, insulated electrode, develop a charge of the same sign when the crystals are subjected to pressure. From the third electrode a lead extends through the axis of the pick-up device.

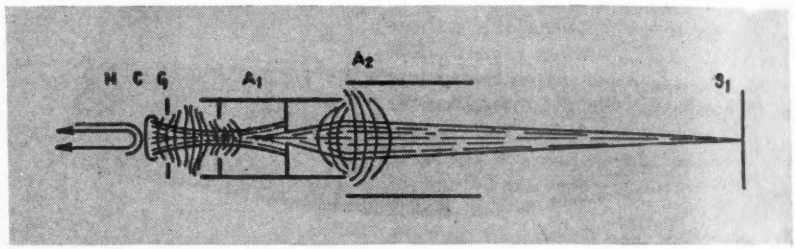


Fig. 2—Sketch showing condensation and focussing of cathode rays on phosphorescent screen

In making ordinary vibration tests (frequency and amplitude), the pick-up device shown is merely held against the vibrating body. The crystals in the pick-up device are supported at three of their corners, and any vibration imparted to the pick-up device is transmitted to the crystals through the mounting surfaces. The mere inertia of the crystals results in deformation of the crystals when they are subject to vibration, and the resulting variations in voltage between opposite faces of the crystals are registered by

the oscillograph on the tube screen.

The oscillograph can be used also for determining the amplitude and frequency of torsional vibration. In that case a special type of detector is used, consisting of two simple alternating generators, each mounted at one end of the shaft which is believed to be vibrating torsionally. Each alternator consists merely of a horse-shoe magnet, with a coil surrounding each leg of the magnet, and the poles so arranged that there is only a small gap between them. An aluminum disk with toothed edge is mounted on each end of the vibrating shaft, and so arranged that the teeth of the disk pass between the poles of the magnet at that end. The effect of the passage of the teeth between the poles of the magnet is to induce voltage waves of approximate sine form in the windings on the magnet. One of the magnets can be adjusted angularly relative to the axis of the vibrating shaft. Connection is made from the coils of the magnets to the horizontal and vertical deflecting plates respectively. When sine wave electromotive forces which are in phase with each other are impressed on the two pairs of deflecting plates, the spot of light on the screen of the cathode-ray tube is caused to describe a straight line at an angle of 45 deg., that is, midway between horizontal and vertical, and the length of this line is a measure of the amplitude of the voltage impulses. When there is torsional vibration in the shaft, the voltage waves from the two generators are no longer in phase, and instead of a straight line, the spot of light then describes a geometrical figure. One of the generators is then adjusted angularly until the spot of light again describes a straight line, and the adjustment required is a measure of the amplitude of the torsional vibration. For determining the frequency of the vibration, the two generators are connected in parallel to the vertical deflection terminals of the oscillograph, while the horizontal deflection terminals are connected to the relaxation oscillator.

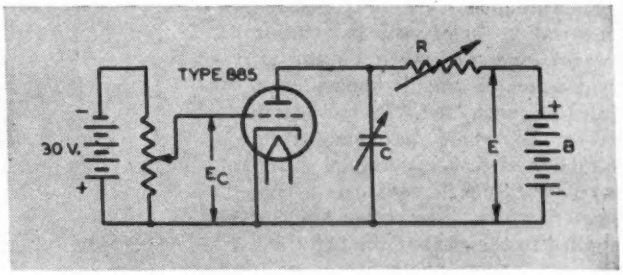


Fig. 4 — Simple sweep-circuit oscillator with current-limiting resistor

The entire set is contained in a handy portable case, measuring 14 in. in height, 7¼ in. in. width and 17¾ in. in. length. It has a considerable number of control knobs on the front, similar to those of a radio set. Referring to the photograph of the unit, the knob at the upper left serves to switch on the power, and when turned further controls the intensity of the spot of light by changing the grid voltage and thereby the rate of emission of electrons from the cathode. The "Focus" control knob on the opposite side operates on the 1200-volt bleeder potentiometer, changing the voltage of anode No. 1, which with a constant voltage on anode No. 2, determines the distance from the cathode at which the beam of electrons comes to a focus. The focus knob is adjusted until the spot of light on the screen reaches its maximum distinctness for the particular setting of the intensity knob. Amplifier A operates a switch which connects the vertical output terminals to the vertical deflecting plates either directly or through an amplifier. There is a condenser in the input circuit in each case.

Amplifier B also operates a switch, and this has three positions, marked "Timing," "On," and "Off." When this control is set in the "Timing" position, the relaxation oscillator feeds through an amplifier to the horizontal deflecting plates of the cathode-ray tube. When it is in the "On" position the "Horizontal" binding posts are connected through an amplifier to these deflecting plates. When in the "Off" position the binding posts are directly connected to the deflecting plates. In each of the last two positions there is a condenser in the input circuit.

Amplifier A Gain Control (vertical) acts on a potentiometer on the input circuit of the vertical amplifier. It controls the vertical deflection when Amplifier A is in the "On" position. Amplifier B Gain Control (horizontal) acts on a potentiometer on the input circuit of the horizontal amplifier and controls the horizontal deflection when Amplifier B is in the "Timing" position or "On" position. The Range switch selects one of eight timing capacitators and gives eight frequency ranges as follows:

Range No.....	1	2
Frequency....	4-14	12-46
Range No.....	3	4
Frequency....	40-160	130-450
Range No.....	5	6
Frequency....	300-1050	900-3500
Range No.....	7	8
Frequency....	2000-7500	5500-18000

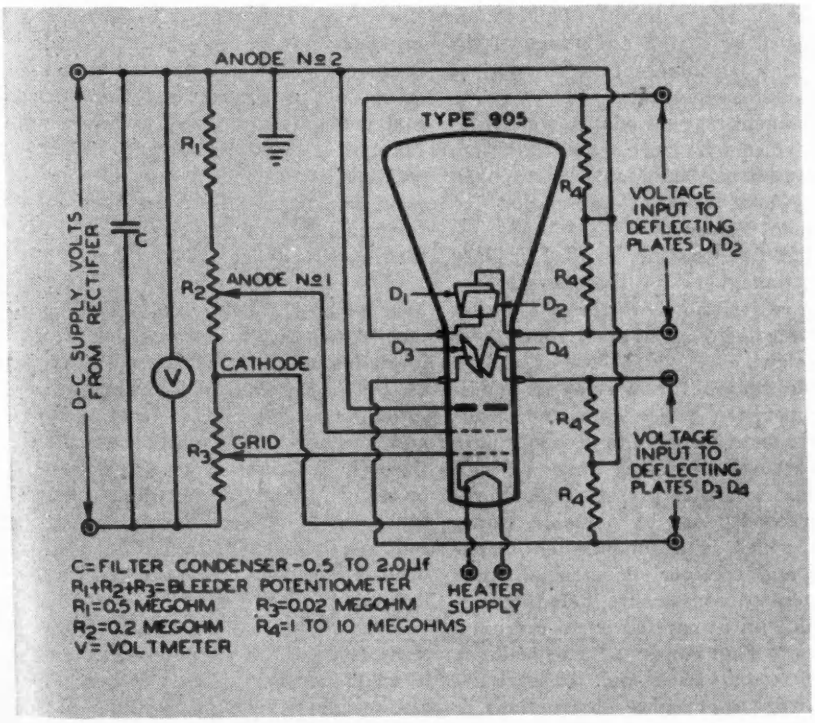


Fig. 3—Typical oscillograph circuit

The knob marked "Freq" controls a rheostat in series with the timing condenser and serves to obtain a close regulation of the frequency. In conjunction with the "Range" switch it gives the whole frequency range of 4-1800 cycles per second. The knob marked "Sync." controls a potentiometer which determines the voltage applied to the grid of the 885 tube. The "Sync." switch has three positions, "Int.," "60 Cycle" and "Ext." When it is in the "Int." position, the voltage drop across the resistor in the plate circuit of the vertical amplifier is delivered through the "Sync." control and the input transformer to the grid of the 885 tube. Thus the timing-circuit oscillator can be synchronized with the signal on the vertical axis at the fundamental frequency or any simple fraction thereof, such as ½, 1/3, etc. Synchronization is not effective if it is attempted to operate the timing axis oscillator at a higher frequency than that of the synchronizing voltage. On "60-Cycle" a 2.5-volt 60-cycle voltage is impressed across the "Sync." control and can be used to lock the timing-axis oscillator at 60, 30 or 20 cycles. On "Ext." the "Ext. Sync." binding posts are connected across the "Sync." control. This allows the use of an external source for synchronizing.

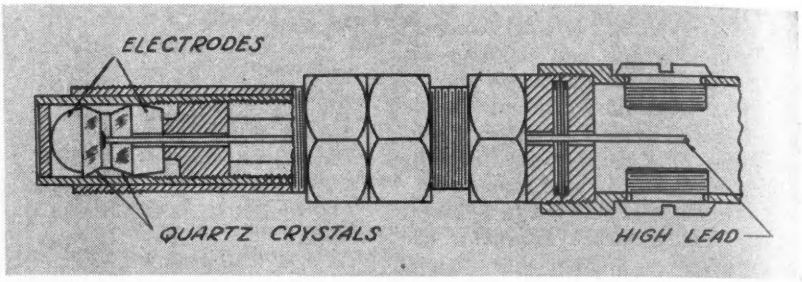


Fig. 5—Sectional view of piezo-electric pick-up device for engine-indicator purposes

On the right-hand side of the cabinet, toward the rear, there are two potentiometer controls which are slotted to take a screw driver. These potentiometers control the d-c voltage between the two deflecting plates of each pair, thereby permitting of adjustment of the position of the spot of light or of the image. The rear control is for the horizontal and the forward one for the vertical deflection of the cathode ray.

There are three pairs of binding posts on the unit. Voltage impressed on the posts marked "Vertical" will give a vertical deflection; voltage impressed on the posts marked "Horizontal" will give a horizontal deflection. The posts marked "Ext. Sync." are used when it is desired to synchronize the timing-axis oscillator with some external source. Of each pair of binding posts one, marked O, is grounded while the other, marked "High," is insulated from ground.

Electrical Developments of 1935

A REVIEW of "Developments in the Electrical Industry During 1935," by John Liston of General Electric Company, lists many items that are of direct or indirect interest to automobile men. Anything relating to the application of Diesel engines to transportation is of automotive interest, and in this connection Mr. Liston points out that the outstanding feature in Diesel-electric transportation was the increase in the size of the unit powerplants employed for both Diesel-electric locomotives and rail cars. The latter now have engines rated as high as 1200 hp. and there was under construction at the close of the year a freight locomotive equipped with a single 2000-hp. Diesel engine. The most powerful equipment so far placed in service consisted of a two-unit locomotive with a total of 3600 hp.

The use of the trolley coach was extended by additions to existing equipment and the initial adoption of this type of vehicle in Dayton, Cleveland and San Francisco. The all-service vehicle, which is a combination of the trolley coach and gas-electric bus, also came into wider use.

An oscillograph "with a memory" was constructed for laboratory use which is capable of showing electrical events that occurred prior to the time of opening the shutter. This is accomplished by taking advantage of the brief time lag inherent in the use of a phosphorescent screen.

Permanent-magnet alloys were produced so much more powerful than those previously available as to open entirely new fields of application for permanent magnets. They have already been successfully applied in place of electromagnets for the operation of certain relays and contactors. The new magnets will lift about sixty times their own weight.

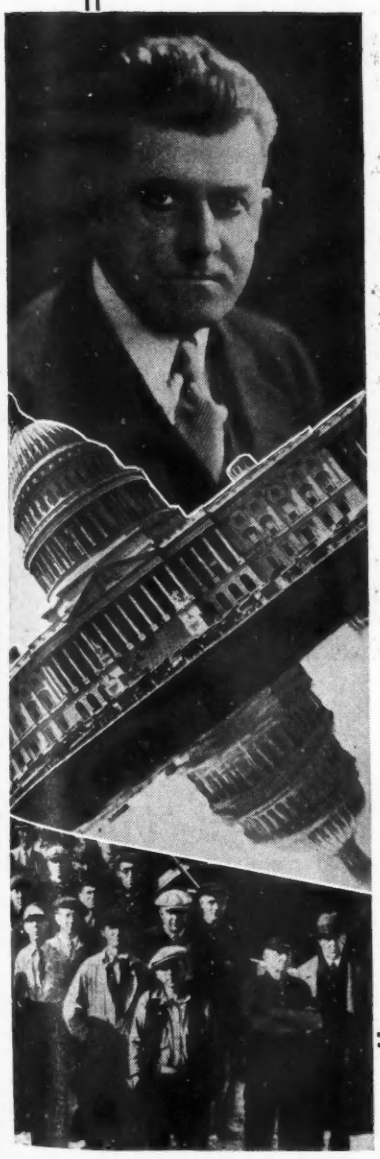
New radio sets for two-way communication between poilce cars and headquarters were designed to give adequate coverage over increased areas as well as in districts that present difficult reception conditions. A portable transceiver, which is a combination transmitter and receiver, is so small that the complete equipment, including the antenna, can be carried in an ordinary suitcase. The power of this midget station is one watt, and its effective range with intervening obstructions is about one mile.

Among the many instruments devised for special measurements were a line of pressure and temperature indicators for aircraft, an enamel thickness gage, an electric strain gage, a time-interval comparator for use with electric furnaces, an iron detector for inspection and protective purposes during manufacture, a cycle recorder to facilitate welding operations, a portable electric wave analyzer, and a sound-level meter for checking the sensitivity of microphones.

New lamps produced included a double-bar filament, pre-focused automobile headlight lamp in which the lower-intensity light beam is directed to the right and downward, clearly illuminating the right side of the road and thereby encouraging the motorist through self-interest to use the lower level of illumination when meeting other cars. A new luminaire, 50 per cent more efficient than its most efficient predecessor, was designed for street lighting.

A change in the cathode construction of the sodium vapor lamp resulted in an 11 per cent gain in efficiency and also permitted a simplification of the auxiliary equipment.

Overboard with APATHY!



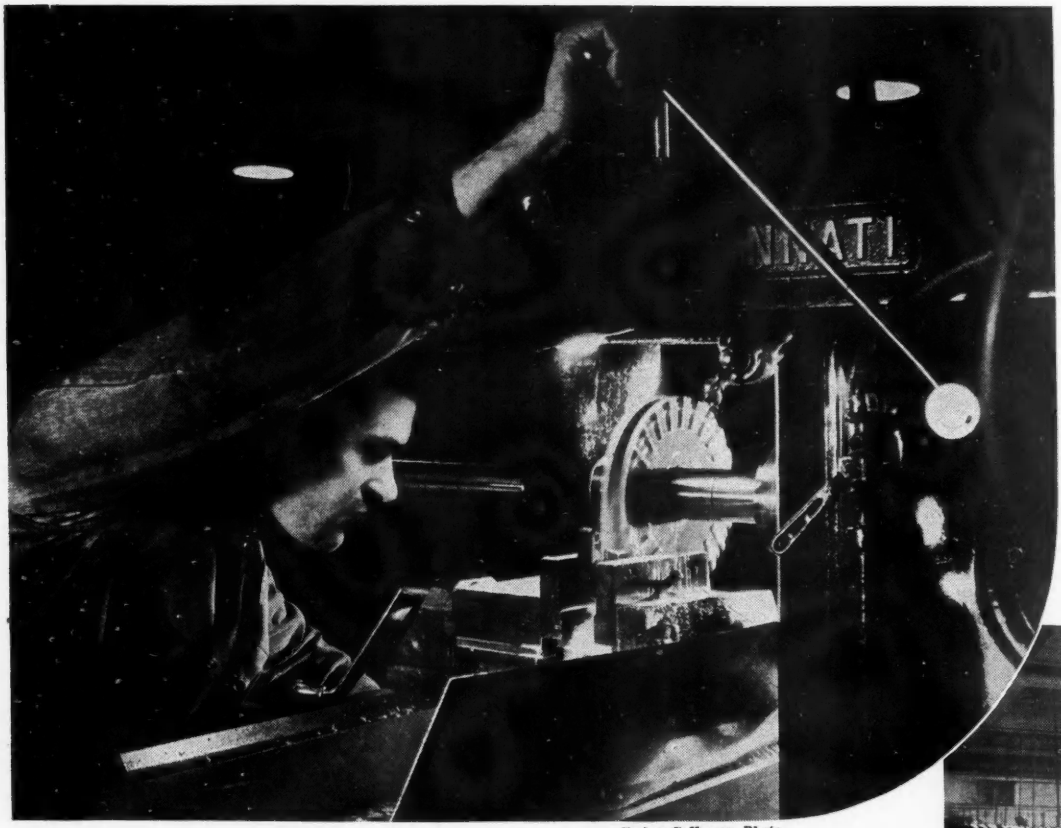
"A JUSTIFIEDLY startling experience of the present Congress resides in the apathy of commercial and industrial interests toward what is transpiring that is of unquestioned vital concern respecting the future of enterprises for the welfare of which executives are responsible.

"Labor and many other organized interests unfriendly toward capital are vigorously, intelligently and persistently active.

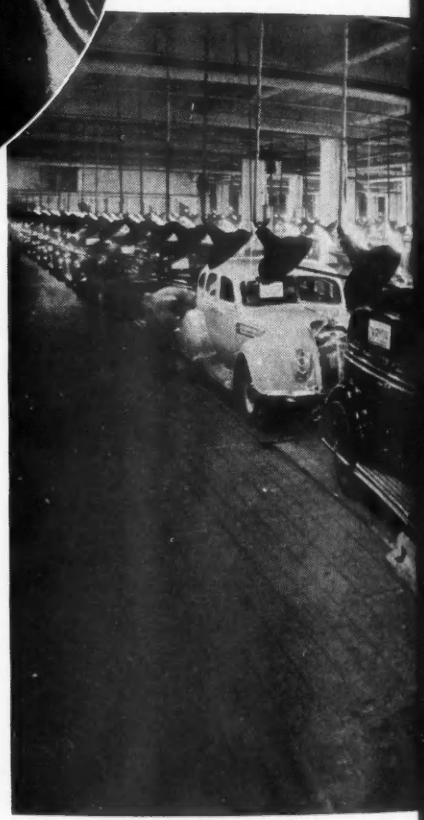
"Here and there are business executives who, realizing what threatened legislative encroachments on the legitimate rights of commerce and industry will mean, are giving their time and energy and money toward efforts to combat hasty enactment of destructive laws.

"Such commercial and industrial vigilants are entirely too few in number. For every sane reason they should have the active interest and intelligently cooperative support of countless thousands of their fellow business executives who with remarkable shortsightedness—in view of what they've all been through during the past several years — remain among that class who think the others will somehow see that all problems affecting commerce and business will miraculously be taken care of."

We feel that these views of Albert H. Eicholz, general manager of the Motor and Equipment Manufacturers Association, are worthy of wider dissemination than that first given them by appearance in a bulletin of the association. They reinforce our contention that protection of the American system of enterprise requires an informed electorate and that industrial executives have a responsibility for spreading as broadly as possible their sound views on the nation's business.



Ewing-Galloway Photo



FATIGUE has been recognized as the natural enemy of economical manufacturing procedures and in recent years, particularly, much effort has been directed at ways and means of increasing worker comfort. In this there has been a happy combination of the humanitarian as well as the utilitarian objectives and fortunately the human element has been well served without sacrifice in production efficiency. As a matter of fact, all scientific efforts at increasing or improving worker comfort have resulted in increased productivity and generally in better quality.

In approaching the matter of fatigue-elimination we find a number of elements taking the leading role. Perhaps the biggest contribution has been made by the mechanization of various operations—mechanical handling devices and conveyorizing, and improvements in machinery controls occupying the very center of stage. Recently, as in the case of the Buick foundry, this development has finally penetrated the foundry with its usual back-breaking tasks, now immeasurably lightened.

Motion-study has been the foremost achievement in recent years. With this technique the industrial engineer has analyzed the detail operations of small assembly work, inspection, and other repetitive work where speed as well as quality are linked with fatigue-elimination. By introducing rhythmic motion, by the elimination of waste movement, and by other devices, principally mechanical, it has been possible to reduce fatigue, increase worker comfort, and thereby increase efficiency to a startling degree.

Now through the efforts of an independent group of scientists working in an entirely different field of activity—the worker as a human seeing machine—we find the clue to a new element which bids fair to offer the final solution to fatigue-elimination by judicious combination with the available techniques.

Just this past year, Dr. Matthew Luckiesh, director of the lighting research laboratories at Nela Park, and his associates completed a series of experiments which shows beyond a doubt that "seeing is a partnership of lighting and vision" and that the quality of lighting is responsible for fatigue in the real physical sense. It has been proved that inadequate lighting, glare, lack of contrast between work and background, and other related factors can make a worker just as tired as manual exertion and this project goes far to imply that even the best results of motion-study may be nullified, to a degree, if lighting has not been considered as a necessary part of the set-up.

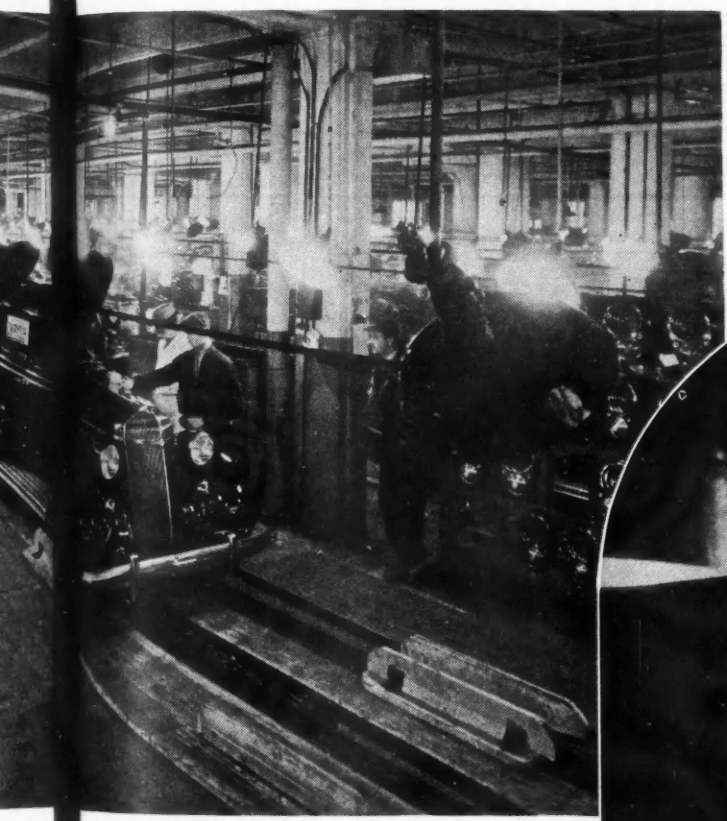
Most of us have had the experience of driving in a fog or a heavy rain or on a sleety pavement where the effort of seeing has been accompanied by nervous tension manifested by a tightening of the grip on the steering wheel. And as an aftermath, we are usually pretty well fagged out despite the fact that comparatively little manual effort has been expended. Precisely the same effect occurs at work-places where the quality of lighting is inadequate.

Under Dr. Luckiesh's direction tests were made to determine the presence and severity of nervous muscular tension—due to the effect of seeing upon

LIGHT . . .

Industrial engineers augment former technique of time and motion study with new manual of scientific illumination. Speed, precision and quality reach new standards.

By Joseph Geschelin



Keystone Photo

the whole body—in the simple act of reading under comfortable conditions where the lighting source was controllable. This project was much too comprehensive to permit of even meager description in this article. However, look at Fig. 1, which is a summary of the result of a million observations under controlled conditions. It shows that the tension increases markedly as the intensity of the light source is diminished, and decreases as the intensity is increased. It approaches a low value at 100 foot candles and disappears at 1000 foot candles, which is the

usual illumination in nature on a summer day in the shade of a tree.

In addition to muscular tension there is the added element of depressed heart action under the same conditions. Both combine to produce physical fatigue regardless of other favorable factors.

Some of the criteria that enter into the relationship between intensity of illumination and ease of seeing are shown in Fig. 2, taken from a paper by Luckiesh and Moss, published in the *Journal* of the Franklin Institute, October, 1935.

While the whole subject of seeing is a matter for the expert, his task has been simplified and in fact the whole subject has been opened to the engineer by the availability of the visibility meter. As shown in Fig. 3 it is an instrument for appraising the relative visibility of various objects and visual tasks and for specifying practicable levels of illumination upon a rational basis. This instrument was developed at Nela Park.

Another element that enters into the problem of effortless seeing is described by Dr. Luckiesh in a recent paper read at the annual convention of the Illuminating Engineering Society. He says in part: "In the work-world there are many effects of adaptation, most of which are hidden, but are none the less real. If the visual task involves frequent rapid shifts in fixation between areas of different brightnesses, a brief lag in adaptation may be a serious visual handicap even though the difference in brightness is relatively small. This is proved by the results of a research, in which the workers were forced to alter fixation between different brightnesses as rapidly as they could recognize the test-object in either field. In this case, a decrease in visual efficiency became measurable when the brightness of one field was only twice that of the other.

"Some typical results are of interest. For example, the amount of work done was 12 per cent less when the eyes alternated between two brightnesses one of which was 100 times greater than the other compared with the amount of work done when the brightness was uniformly the higher brightness. Such a brightness-ratio is a common result of a combination of diversity in reflection-factors and intensities of illumination. When one brightness was only 20 times the other the reduction in work done was 5 per cent. Such a brightness-ratio commonly results from reflection-factors alone. Most of this decrease in efficiency of the worker was due to the necessity for continual readaptation. Doubtless undesirable psychological effects also resulted."

Thus a new vista is open to the industrial engineer. After mechanization, after careful motion-study, after analysis and control of all the other factors relating to an operation, consider seeing as the final step of control. This element neither complicates the problem nor does it impose any added costs, for it can be shown that the cost of illumination is far outweighed by the improvement in productivity and quality. And surely quality with its freedom

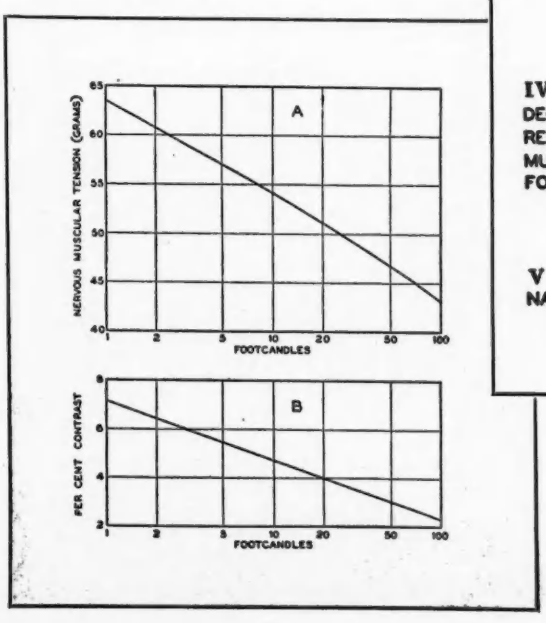


Fig. 1 (Left)—This graph shows a summary of a million observations for physical fatigue from eye strain under controlled conditions of illumination

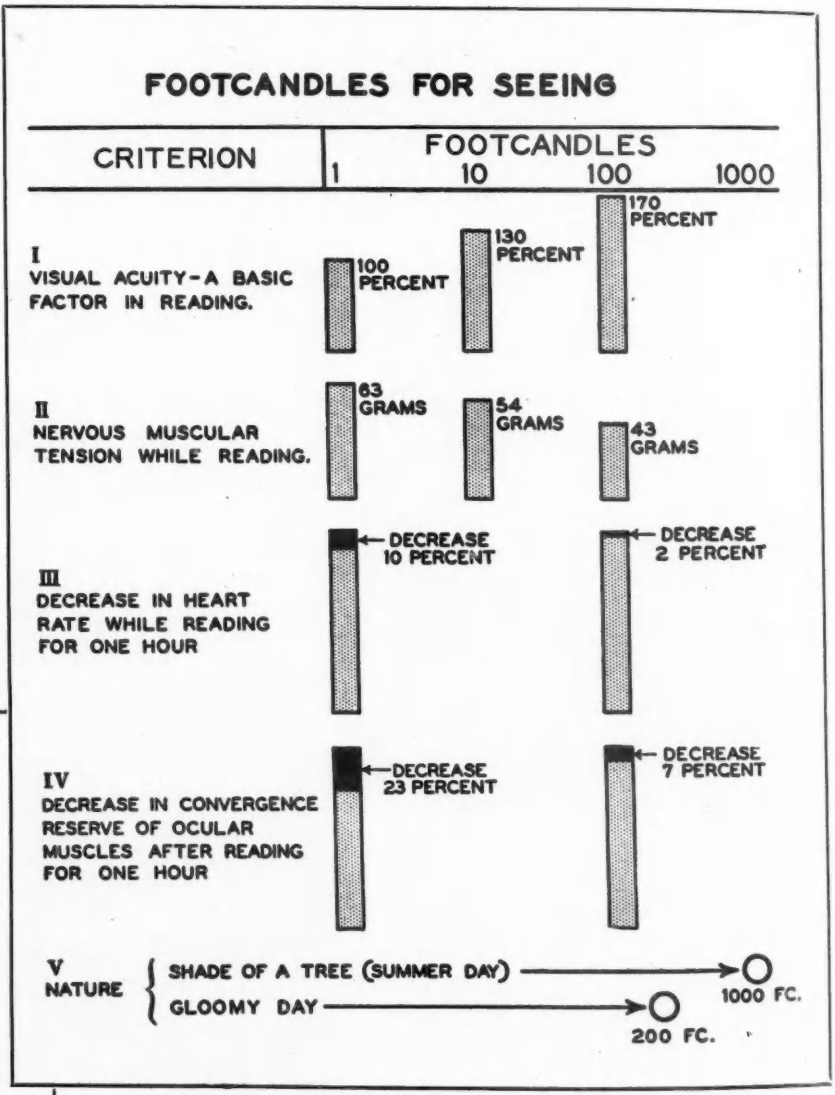


Fig. 2 (Above)—Some of the criteria that enter into the relationship between intensity of illumination and ease of seeing

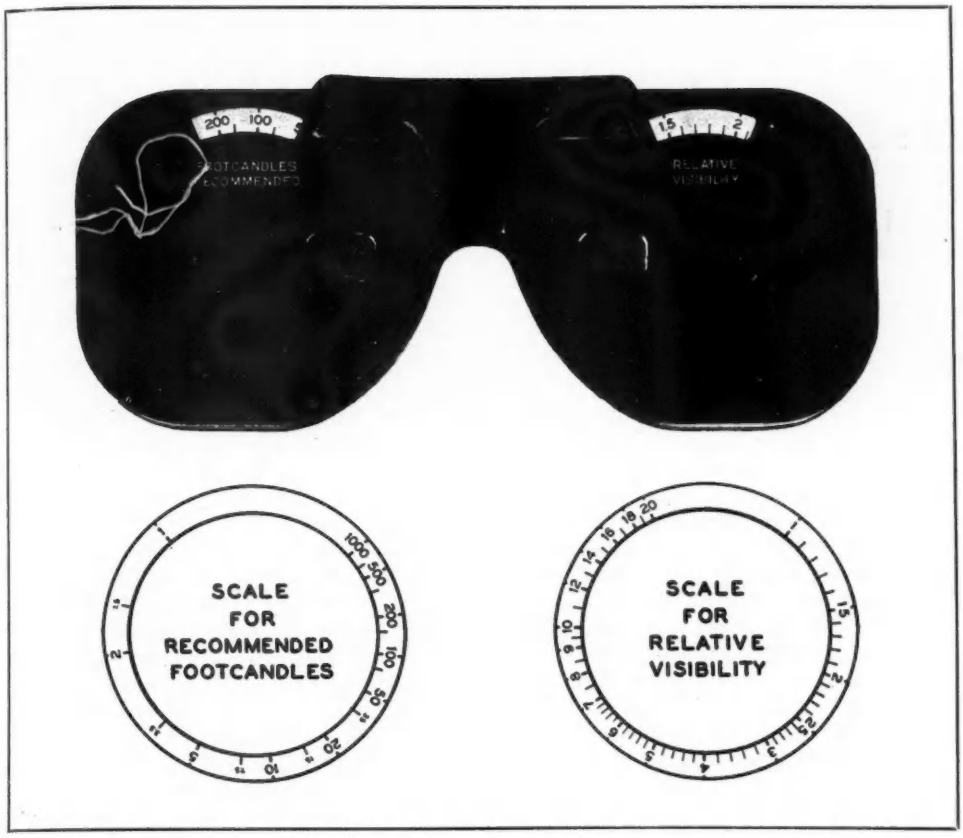


Fig. 3—The visibility meter is an instrument for measuring the relative visibility and for specifying levels of illumination

from spoiled work is a desirable virtue in mass production.

Realizing the need for a compromise between ideal conditions and the present inadequacy of lighting, Dr. Luckiesh makes the following the foot-candle recommendations for common tasks:

One hundred foot-candles or more—For very severe and prolonged tasks, such as fine needlework, fine engraving, fine penwork, fine assembly, sewing on dark goods and discrimination of fine details of low contrast, as in inspection.

Fifty to 100 foot-candles—For severe and prolonged tasks, such as proof-reading, drafting, difficult reading, watch repairing, fine machine-work, average sewing and other needlework.

Twenty to 50 foot-candles — For moderately critical and prolonged tasks, such as clerical work, ordinary reading, common benchwork and average sewing and other needlework on light goods.

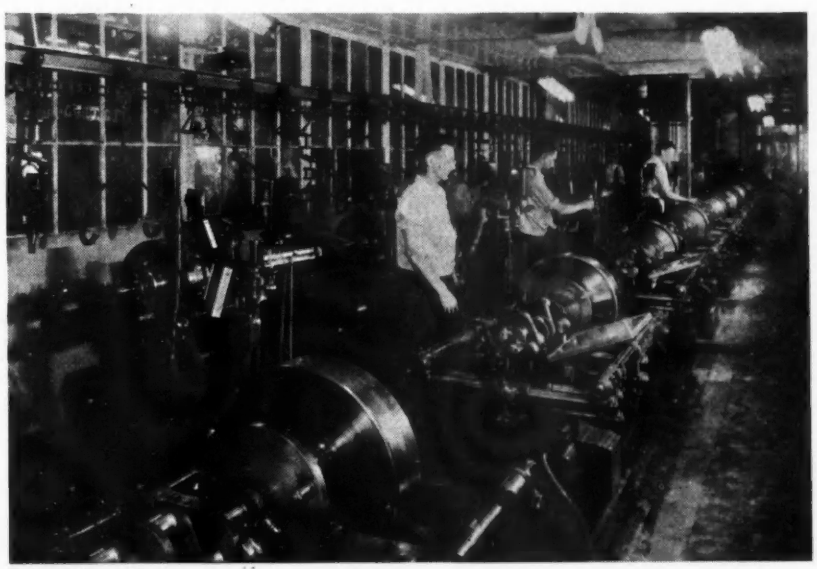
Ten to 20 foot-candles—For moderate and prolonged tasks of office and factory and, when not prolonged, ordinary reading and sewing on light goods.

Five to 10 foot-candles—For visually controlled work in which seeing is important, but more or less interrupted or casual and does not involve discrimination of fine details or low contrasts.

Ought to 5 foot-candles—The danger zone for severe visual tasks, and for quick and certain seeing. Satisfactory for perceiving larger objects and for casual seeing.

We are much impressed with the contribution of Nela Park to industrial engineering. Here again is an excellent example of how the welfare of the worker, in this case the conservation of the seeing machine, can be improved by an expedient which pays for itself in increased productivity or better quality or frequently by a combination of the two.

There is a rich bibliography on this new science of seeing, much of it couched in non-technical terms and hence of immediate practical value. We can make this information available to anyone interested.



Ewing Galloway Photo

Positive Displacement Vane-Type Blower

A NEW positive-displacement, vane type of blower has been developed by H. J. Kratzer of St. Louis, Mo., for which the advantages of high volumetric displacement for given over-all dimensions and a minimum number of parts subjected to frictional effects are claimed. The blower comprises a three-vane rotor 7½ in. long, within a housing of 5-in. diameter, and has a theoretical displacement of 147 cu. in. per revolution. There is a slight clearance between the bent vanes and the bore of the housing, and there are frictional effects only between the central shaft and its sleeve, at the pins at opposite ends of the vane-operating links, and, of course, at the rotor bearings.

The rotor proper consists of three rods which are supported and pinned to the driving and idler disks at their respective ends of the blower. The three longitudinally-bent vanes are rotatably supported on a stationary housing. Each vane is actuated from its rotor rod by means of three pairs of links, which latter are secured at one end to a sleeve mounted over a rotor rod and at the other end are hinged to the vane support.

The axis of the rotor is offset from the axis of the housing by approximately one-eighth the bore of the latter. In operation, this eccentricity of the rotor results in a planetary toggle action of the links, which in turn causes the vanes to accelerate while in the pumping sector and to decelerate while in the return sector. From the cross section it will be seen that one vane is slowly moving through the return sector while another is rapidly displacing the contents of the pumping sector into the discharge connection, and the third sector is being accelerated across the intake port, which, however, is not passed until the preceding pumping van has been carried ahead approximately 186 deg.

One reason for the longitudinal bends in the vanes is that they reduce to a minimum the volume between adjacent vanes during the return stroke, and another that they add to the longitudinal rigidity of the vanes between supports. By assembling pairs of links to the rod sleeves in advance, proper alignment of the links is assured, and grease is held in place on the bearing surfaces of the sleeves. Lubricant for the other pin and shaft bearings is obtained from a slow oil feed. It is claimed that the elimination of sliding friction at other points than the pin and shaft areas assures a high mechanical efficiency over a long life.

Owing to the "return volume" the efficient pressure range of the blower is limited to approximately 8 lb. per sq. in., which, however, is said to be well above any automotive requirements.

Mr. Kratzer believes that the deci-

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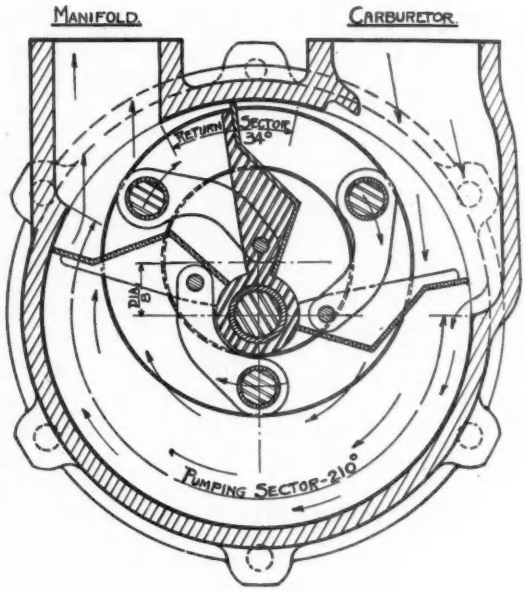
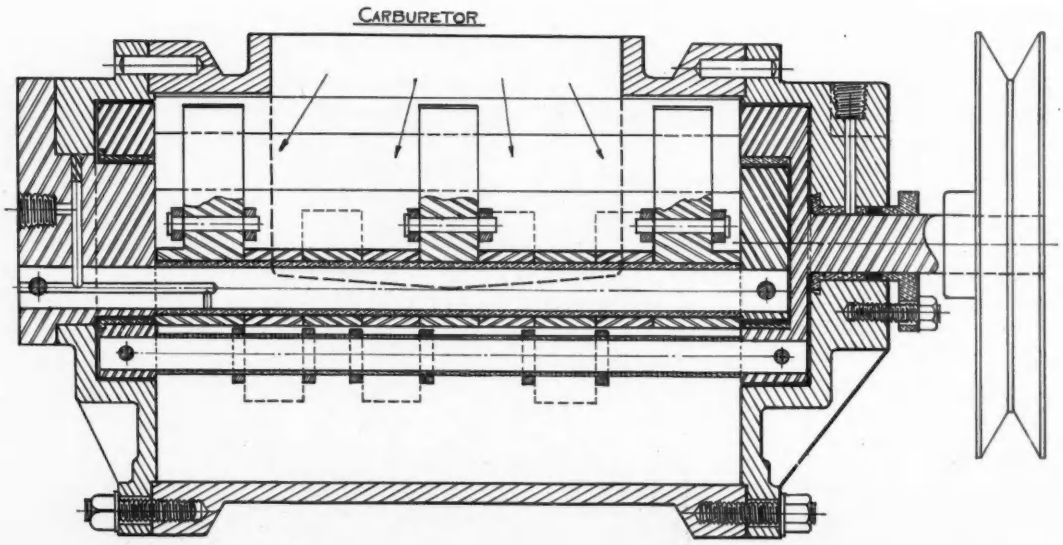


Longitudinal and transverse sections of the Kratzer blower



The Horizons of Business

By Joseph Stagg Lawrence

The New Tax Measure

IN a campaign year rich with the promise of bitterness, with the tide running so strongly against the administration that betting brokers are accepting even money wagers either way that the president will not be reelected, Congress is nevertheless asked to consider a new tax measure. Now it is an axiom of politics that the voter should not, in a campaign year be reminded of his duty to foot the bills of government. The state and its servants who stand for election should appear as the ministers of favor and benefit offering balm for the discontented, reward for the successful and soothing anodyne for the failures.

Sudden Deficit Consciousness

There is another reason why the proposal of a revenue measure in a campaign year demands an explanation. When the president delivered his budget message to Congress on Jan. 6 he indicated a deficit of $1,098 million *ex* relief. A week later his Secretary of the Treasury, testifying before a Senate committee, estimated relief requirements at $2,000 million. This adds up to a total deficit of three billions and if a deficit *per se* calls for an increase in revenue, three billion dollars would seem to be a clear enough clarion call for more taxes.

A Supreme Court decision a few days after the President presented the budget made his revenue calculations obsolete. Congress compounded the difficulty by passing the bonus. These two items practically doubled the anticipated deficit of three billion and constituted the cue for the preparation of a new tax measure.

Excise Taxes

One part of the tax program embraces a broad list of excise taxes, chiefly on foods and necessities, designed to take the place of a part of the invalidated processing taxes. The sharp reduction in the rates, the broadening of the base and the assurance that these taxes are but temporary betray the reluctance with which the Administration makes these suggestions. A tax on foodstuffs in order to pay the farmer a subsidy for producing less food is difficult to explain satisfactorily to city voters even with the highly elastic lexicon of politics. However, the groove had been established by the processing taxes and it would be extremely difficult to shift at once the entire burden of raising farm income to a parity with industrial income. If Congress passes this part of the tax bill it will do so with the grace and elation of a six-year-old taking a necessary dose of castor oil.

A Labor of Love

The tax on the undistributed earnings of corporations is something else again. It was a labor of love for the Treasury. This suffers from little if any of the disability which attaches to other tax measures even in a campaign year. Politically speaking the new plan has a great deal of sex appeal. It attacks huge corporate surpluses (of the future). It increases the taxes of individuals in the upper brackets. It raids the caches of personal holding corporations. It promotes a wider diffusion of "purchasing power." These are virtues which can be expounded with the most convincing plausibility.

A Tax on Size

The tax on corporate surplus is a tax upon the undistributed net earnings of corporations. The rates have not yet been settled. The Treasury seems to have in mind a range of 15 to 45 per cent. The rates will apply to absolute amounts of earnings and not to percentage. The lowest rates will apply to undistributed earnings between zero and $2,000, the highest to earnings above $50,000. The figures are not definite. Logically it would seem that a tax like this would be applied on a percentage basis, the lowest rate applying, let us say, to a corporation which distributes 90 per cent of its earnings and the highest to the corporation which distributes less than 50 per cent.

The effect of graduation by amounts instead of percentages is to subject the large corporation to the maximum tax. Let us look at some of the earnings statements that have come to hand during the week. Armstrong Cork, a large company but certainly not among the giants showed $3,434,912. In order to pay less than the maximum tax it would have to pay out more than 98.5 per cent of its earnings. Calculations for companies with larger earnings are unnecessary. For practical purposes every large corporation, when it makes any money at all, must pay it all out to stockholders or suffer a tax of 45 per cent on the undistributed portion.

A Tax on Foresight

The tax has three distinct purposes. The first, we hope, is to raise revenue. The second is to reach the personal holding corporation which has accumulated the surplus earnings of the individual subject only to the prevailing taxes on corporate earnings. These are much lower than the income taxes in the higher brackets. The personal corporation has therefore been a refuge of the wealthy from the exactions of the tax collector. This refuge the new tax will make untenable. The third object is to force corporations against their own judgment to pay out all their earnings. It is a mass substitution of tenuous theory for corporate judgment. It is another skirmish in the large offensive of the New Deal against thrift, foresight and self reliance which are virtues no less in the corporate than in the personal form. It is a phase of the broader sophistry that extravagance is a more certain road to economic progress than thrift. The grasshopper of fable is again exalted. Once more the ant faces the firing squad.

Emergency Technique

It is difficult to gage the precise importance of this philosophy as a motive for the tax. Its appearance no longer rates as news for it is implied in so many other phases of government conduct. The manner in which the measure is presented is significant. Here is a radical departure from all previous forms of corporate taxation. It is difficult to foresee the full ramifications of this tax. It is offered to Congress accompanied by window dressing which again suggests an emergency. Congressmen are eager to go home and prepare for election. The last three billion of an aggregate ad-

(Turn to page 420, please)

AUTOMOTIVE ABSTRACTS

Diesel Fuel in Germany

GERMANY has recently doubled the import duty on gas oil (Diesel-engine fuel), and while this will increase the cost of Diesel power, it is far from canceling the economic advantage of the Diesel engine. The increase in the duty will add only about 3 per cent to the total operating cost of Diesel engines, and the fuel cost of Diesels will still be ony 70-74 per cent that of gasoline engines.

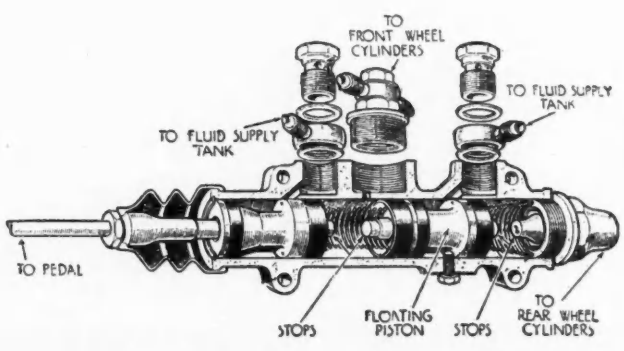
In 1932 the consumption of gas oil in Germany represented 16 per cent of the total motor fuel consumption, and the figure was increased to 25 per cent in 1935. This large increase in the use of gas oil was due mainly to the rapid increase in the use of Diesel engines for motor vehicles. Diesel motor trucks and tractors consume about 160,000 tons of fuel annually. The increase in the price of Diesel fuel will not affect the operation of tractors and of motorboats on inland waters, and stationary installations will be only slightly affected; it is expected that the use of Diesel engines for motor trucks will continue to increase in spite of the increased cost of fuel, so that between 700,000 and 750,000 tons of Diesel fuel will have to be provided annually for years to come. In 1935 Germany consumed approximately 6 per cent of the world production of gas oil.—*ATZ*, Jan. 10.

Safety Feature for Hydraulic Brakes

AN elaboration of the Lockheed braking system has been introduced (in England) in the form of a duplication of the operating mechanism for the front and rear-wheel brakes. It is termed a tandem master cylinder and provides separate fluid outlets for application of the front and rear shoes. There are two separate circuits of oil, with pressure applied by two pistons instead of one, hence one line can become ineffective without affecting the other one.

A cylinder rather larger than usual accommodates a floating piston in the middle, with inlet and outlet pipes on each side of it. When the pedal is depressed, pressure is created in the forward chamber and, owing to the fact that the central piston is not fixed, pressure is produced also in the rear chamber and all four brakes are applied.

If a leak occurs in the line controlled by the primary cylinder, the pedal-applied piston travels for a short distance (always slightly greater than the distance required for hydraulic application of the shoes when the system is working in its normal manner), and a stop engages a button on the floating piston; this allows the pedal pressure to be exerted on this piston, which then compresses the fluid in the secondary chamber. Conversely, a failure in the secondary line allows the floating piston to abut a stop at the end of the master cylinder, leaving pressure in the primary chamber.—*The Motor*, Oct. 29.



Sectional view of master cylinder with two independent pressure lines.

British Production Tops 1934 High

THE record production attained by the British automobile industry in 1934 was surpassed in 1935. In the production of commercial vehicles also a new high record was set during the past year, though the increase was not so great as in that of private cars.

Employment figures are grouped for the motor, motorcycle, bicycle and aircraft industries. The number of people actually employed in these industries rose from 242,711 in 1934 to 259,292 in 1935, and the number of unemployed persons registered in these industries decreased.

Production of passenger cars by British manufacturers has been as follows in recent years (ending Sept. 30 of the respective years):

Year	Number of Cars Manufactured
1931	158,997
1932	171,244
1933	220,779
1934	256,866
1935	311,544

Since the horsepower tax was reduced about two years ago the proportion of large cars registered has increased considerably. Cars of over 26 tax hp. constituted only 1.6 per cent of the total registered in 1932-33, and the proportion rose to 3.8 per cent in 1933-34. It is believed that most of these larger cars were imported from the United States and Canada, but British makers are now paying more attention to this class. The great demand, however, continues for cars in the small horsepower classes. Total registrations increased by about 152,000 during the year, from which it is concluded that at least that number of people bought cars who had never owned one before; and by comparison with income statistics the conclusion is arrived at that most of these people have incomes of between £300 and £400 per year. To maintain a car on such an income it is necessary to reduce expenses to a minimum, and the lower operating cost of the small car, aside from its lower tax rate, restricts their choice to that type.

The tax reduction, however, has had the effect of inducing car owners to register their cars for the whole year, instead of by the quarter and not registering it during the winter months. During the last quarter of 1934 there was a reduction of only 25,000 in the total number of registrations, as compared with about 90,000 in previous years.

There was also a notable increase in the exports of British passenger cars in 1935. Export figures for the six leading countries for the last three years are given in the following table:

Exports of Passenger Cars

Year	1933	1934	1935
U. S. A.	63,754	143,916	166,800
Canada	14,840	31,274	49,700
Great Britain	41,028	43,907	54,300
France	23,015	24,970	17,100
Italy	6,816	18,859	12,300
Germany	10,844	10,994	18,900

British imports of private cars, which reached a record low value of 2101 in 1931, increased from 10,851 in 1934 to 14,180 in 1935. It is believed that the growth of these imports will be checked shortly by the production of cars of the American type in Great Britain. As regards the export field, it is pointed out that there should always be a good automobile market in agricultural and raw-materials countries, as the successful production of automobiles requires a high degree of industrialization and a large home market.

The production of commercial vehicles in Great Britain has increased steadily since 1932, as may be seen from the following table:

British Commercial Vehicle Production

1931	67,292
1932	61,475
1933	65,508
1934	85,633
1935	92,176

This table shows a gain in production of 7.7 per cent during the past year, and this in spite of the fact that road transport was subjected to restrictions to favor other forms of transport. The Road Traffic Act of 1930 practically put a limit to the expansion of bus services, the only possible remaining method of expansion being by the absorption of other going concerns. The Road and Rail Traffic Act of 1933 placed road freight traffic under the control of the Traffic Commission, and no expansion is allowed unless the need for increased service can be proven. The establishment of new concerns to engage in road haulage is said to be effectively prevented. In both cases the general effect has been to concentrate the road-transportation business in the hands of a few large concerns, and this has had a tendency to divert orders for new equipment to the larger manufacturing establishments. Another effect has been to force the adoption of lighter vehicles, as the limit on haulers is in terms of total unladen weight and not in terms of number of vehicles. This has favored the mass producers such as Morris, Ford and Vauxhall, who have succeeded in applying their passenger car technique to the production of light commercial vehicles.

An important event in the commercial vehicle field was the increase in the tax on Diesel fuels from one to eight pence per Imp. gal. It has not, however, stopped the progress of the Diesel, as shown by the fact that during the period January-August, 1935, more than 50 per cent of all buses registered were Diesel-equipped, as compared with 25 per cent the previous year. In the case of trucks the corresponding figures were 2.6 and 2.7 per cent. The explanation of the large difference between the bus and truck figures is the much more intense use of the buses, which cover an average of 32,700 miles per year, as compared with about 10,000 miles for trucks.

Imports of commercial vehicles into Great Britain reached a low value of 347 in 1932, and the number increased from 1637 in 1934 to 2150 in 1935. In exports of commercial vehicles Canada wrested second place from the United Kingdom during the past year, as shown by the following table:

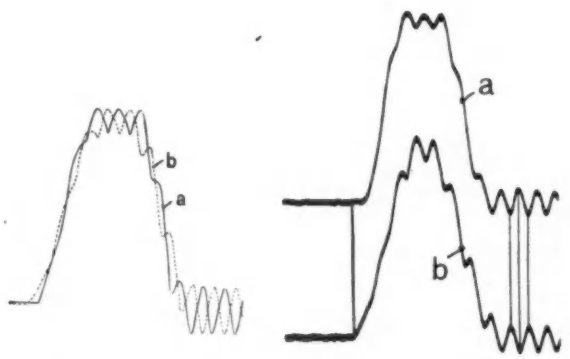
Exports of Commercial Vehicles

Year	1933	1934	1935
U. S. A.	40,658	92,397	97,900
Great Britain	10,673	13,742	13,500
Canada	4,040	12,094	16,100
Germany	2,506	2,250	4,700
France	2,219	3,682	2,600
Italy	537	575	500

The home market for buses has been rather low in recent years, owing to the consolidation of operating companies and the reduction in the number of buses registered from 52,158 in 1930 to 44,687 in 1934. The legislative restrictions and the increase in the tax on Diesel fuel have been disturbing factors, but it is felt that a period of stability may now be looked for.—*Engineering*, Jan. 10.

Spring Surge Investigated

An investigation of the vibrational characteristics of valve springs (spring surge) has been made by Dr. W. Marti, and a thesis based on this investigation was presented by him to the Federal Technical College of Zurich for the degree of Doctor of Technical Science. The problem was attacked by both analytic and experimental methods. In the experimental work use was made of a stroboscope comprising a piezo-electric detector and an oscillographic recorder. One quartz-crystal detector was placed behind the spring washer at the movable end of the spring, and another behind the spring washer at the opposite end, and



Calculated and recorded curves of spring load. a, at stationary, and b, at movable spring washer.

the pressures exerted on the quartz crystals therefore were substantially those on the ends of the coil spring.

From the calculated curves and their agreement with the oscillographic records, the wave character of the spring oscillations is directly apparent. The initial pressure rise after the beginning of valve lift is of the same character as the increase in the velocity of lift, that is, it is linear with relation to time, instead of being parabolic like the lift. At the stationary end of the spring the pressure begins to rise only after one-half the natural period of the spring, that is, after the pressure wave has traveled through the spring from the movable to the stationary end. This is clearly shown in the drawing in which oscillographic pressure records from the two ends are superposed.

Imagine the cam at rest and in a position of "no lift," and that the shaft is brought up to a definite normal speed before the lift begins. During the early part of the lift the pressure on the spring, and therefore the stress in it, increases in direct proportion to the speed of the spring washer. This continues until the pressure wave induced by

the cam, after being reflected at the stationary spring rest, returns to the movable end and is there superimposed upon the initial pressure. Following this the stress in the spring at the movable end at any time corresponds to the momentary resultant of all of the pressure waves traveling through the spring in both directions and varies about a medium line which increases with the lift.

After the first lift there remains a vibration which, in the case of 10 free cycles of the spring per cam revolution, contains the 10., 20., and 30. harmonics of the velocity-of-lift curve. The amplitude of vibration can be determined more quickly with the aid of the superpositions than by harmonic analysis. The magnitude of the vibrations excited by the first lift in relation to the number of free vibrations per revolution shows the designer in what speed range the harmonic vibrations are particularly severe. In the thesis an example is given showing how it is possible to obtain a speed range of considerable width without serious vibration.

If the natural frequency of the spring is a direct multiple of the cam speed the amplitude of vibration will increase by a certain definite amount with each lift. However, as a result of the damping forces in play, a state of equilibrium is reached as soon as the increment per cycle is equal to the damping loss. In connection with a family of curves, a resonance factor is given with which the calculated amplitude of the first lift is multiplied to obtain the maximum amplitude. This resonance factor varies with the magnitude of the damping force and the number of free vibrations per revolution.

The damping force is dependent, not only on the air resistance and the internal molecular friction of the spring material, but also on the arrangement of the spring support (loss on reflection). When the spring is immersed in lubricating oil the damping is sufficiently energetic so that the vibration is damped out during one revolution of the cam.

The theory developed in the thesis was confirmed by numerous experiments with different cams and springs, both ends of the spring agreeing quite satisfactorily with the calculated values.—*Thesis by Dr. W. Marti, Buchdruckerei Winterthur vormals G. Brinkert, Winterthur, Switzerland.*

Tariffs Limit Italian Market

A REPORT on the Milan automobile show in a German publication throws some light on the automobile situation in Italy. Foreign cars are practically excluded from the market by a prohibitive tariff of 2500 lire per 100 kg., or nearly a dollar a pound, which rate applies to cars weighing up to 5700 lb. For vehicles of greater weight the tariff is only 450 lire per 100 kg., or $163 per 1000 lb. The show was held under the shadow of the existing sanctions and the only non-Italian cars exhibited were the Packard, the Mercedes-Benz, and cars of the German Auto-Union.

On Nov. 8 last the price of gasoline rose to $1.06 per U. S. gallon, and under these conditions road traffic is naturally greatly restricted. The automobile business is very quiet in consequence, but the factories are working overtime nevertheless—on war orders. A national fuel known as Agip is being sold and is said to be a blend of alcohol and tar distillates.

A considerable number of well-designed trailers were shown, including trailers for motor buses. Much development work along these lines is being done in Italy at present to meet the urgent requirements of the Army and also because practically all l-c-l freight traffic in Italy is over the highways.

Much importance is attached to the use of producer gas as motor fuel. Purchasers of trucks adapted for operation on producer gas receive a bonus from the government which amounts to $320 in the case of a 2-ton truck, $480 in the case of a 4-ton truck and $720 in the case of 6-ton trucks. Such vehicles, moreover, are exempt from the annual tax for a period of five years, and trucks that are converted to operation on producer gas also enjoy a material reduction in the annual tax. The Fiat Nostrum gas-producer installation has proven quite successful in the service of the Italian Army, and an order for 1000 trucks with this producer installation was placed recently. The truck operates on charcoal, which can be produced at the scene of operations in Ethiopia.—*ATZ*, Jan. 10.

France Coordinating Rail and Road Traffic

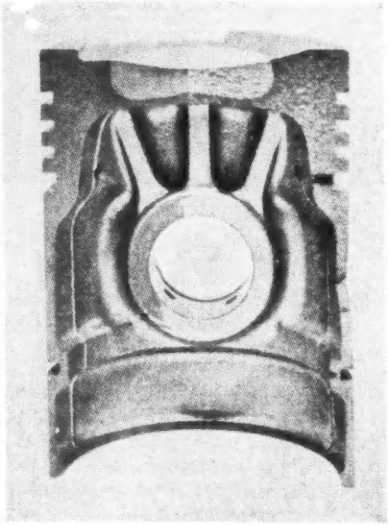
IN France, where the railroads have been rolling up large deficits in recent years, and where the blame for their unprofitableness has been placed at the door of competing road-transport services, a general coordinating committee for road and rail transport was established by a law passed in August, 1934. On the initiative of this committee two further laws were passed, one providing for the establishment of a technical committee in each Departement of the country, to which was assigned the task of working out a plan for the coordination of commercial passenger transportation in the particular Departement, while the other provided for the establishment of committees that were to deal with freight transportation in a similar way. Any plan evolved by a local technical committee was to be submitted through the general committee on coordination to the Minister of Public Works, who in turn was to get the consent of the Departemental Council and the local Chambers of Commerce and of Agriculture to the proposed plan. It seems that so far only five of the proposals submitted have been agreed to by all of the parties concerned and have been returned by the general committee to the Minister of Public Works with a recommendation that they be put into effect immediately.

One point that has come up in this connection is with relation to reimbursement to the owners of abandoned lines. The law makes provision for such reimbursement, but there seems to be some uncertainty as to whether payments are to be made for all abandoned services or only for services that were really profitable to their owners. The charge has been made that numerous bus lines were established only shortly before the law went into effect and that the owners of these lines are not entitled to compensation.

The matter of coordination came up in Parliament recently and the Minister of Public Works there gave assurance that the interests of the traveling public would in no case be jeopardized. He suggested that Departements which did not approve the plans of the technical committees could make counter plans and the matter would then be arbitrated by the General Coordinating Committee.—*Le Génie Civil.*

Light Alloy Piston for Diesel Engines

A LIGHT-ALLOY, composite piston for Diesel engines in which the fuel spray is likely to strike the piston head and cause same to crack in time, has been developed by Ernst Mahle of the Elektron Works in Bad Cannstatt, Germany. The body of the piston is made of a silicon-aluminum alloy and the top central portion of the head of Y alloy. Both alloys are poured substantially simultaneously into the same mold, at such a temperature that the two will amalgamate thoroughly at the junction. In this way the materials in both parts of the piston retain their original characteristics, and at the junction an intermediate alloy is formed which not only will withstand severe tensile, compressive and torsional stresses but also assure a proper transition of the partly contrary properties of the two alloys. In the first attempts the copper-aluminum alloy covered the entire top of the piston head and also the upper part of the ring belt. However, the Y alloy is undesirable at the ring belt, because of its heat-expansion characteris-



tics, and a new foundry technique was then developed which made it possible to form in the center of the head of a piston consisting for the most part of a silicon-aluminum alloy, a circular disk of Y alloy which formed such an excellent joint with the piston body that when the piston was broken through the head the break did not occur at the junction of the two alloys. Details of the foundry method employed cannot be given at this time.—*ATZ*, December 25.

Cast Iron Crankshafts

ENDURANCE tests with crankshafts made of the usual medium-carbon drop-forging steel, pearlitic cast iron, and malleable iron were made by A. Thum and K. Bandow at Darmstadt Technical College. In a report on this experimental work it is pointed out that the general form of present-day crankshafts is based on experience gained in engine manufacture, but is conditioned by limitations of the manufacturing processes such as drop forging and turning. Sudden changes in the direction of forces and sudden changes in section cannot well be avoided. In most cases it is impossible to closely proportion the dimensions of individual parts to the loads which they must sustain. Production of crankshafts by casting would open up a number of new possibilities, especially that of making the stress distribution more nearly uniform. By using hollow members, a considerable saving in weight could be achieved. In order to obtain the necessary stiffness to avoid critical speeds, and also on account of the lower modulus of elasticity, it would be necessary to use larger bearing diameters. It would seem possible to obtain in a cast crankshaft made of a material of relatively low tensile strength the same stiffness as with steel, and to materially lower the production cost.

Both cast iron and malleable iron have an advantage over steel in that they are less sensitive to "notch action," in other words, less sensitive to surface imperfections. Cast iron is essentially a steel with a structure that is permeated by a large number of interior notches, the graphite veins. These graphite veins cannot transmit any tensile stresses, hence they act as notches, and these internal notches so reduce the tensile strength of cast iron that surface imperfections have little additional weakening effect.

Torsional endurance tests were made on single-throw crankshaft models (9/16-in. crankpin diameter) of pearlitic cast iron, malleable iron, and medium-carbon steel. The endurance limit was found to be 14,200 lb. per sq. in. for the cast iron, 16,000 to 17,500 lb. per sq. in. for the malleable iron, and 20,000 lb. per sq. in. for the steel. The malleable iron crankshaft models had the crankpins hardened and the case-hardening had the effect of not only increasing the resistance to wear but also of increasing the endurance limit.—*VDI*, Jan. 4.

Synthetic Rubber Gains New Impetus

IN Germany development work on synthetic rubber has been carried on by the I. G. Farbengesellschaft. The experiments date back to before the war. During the war the scarcity of raw materials made it necessary to go into quantity production prematurely. At that time the basic material from which rubber was produced by polymerization was dimethyl butadien. It was then possible only to talk of a "substitute" for rubber, which suffered from insufficient resistance to abrasion and tear and from insufficient elasticity.

A great deal of development work has been done since that time, and the rubber now produced is claimed to be definitely superior to natural rubber. The raw materials are coal and lime, from which acetylene is produced. From the acetylene the butadien is produced and the latter is polymerized to rubber.

The new artificial rubber is claimed to be superior to natural rubber in not being attacked by oil and gasoline, in being more resistant to heat and to aging, and also more resistant to abrasive effects.

It is hoped to find many new applications for this new product. One is for packing for bearings of gear housings which will permit the use of less viscous lubricants, thereby reducing the friction losses.

The German Army has been using tires made of synthetic rubber for some time in an experimental way and has been subjecting them to very severe tests. As a result of nearly a million miles of testing, it was found that one of the three grades in which the synthetic rubber is being made has approximately 30 per cent more and another 10 per cent more resistance to abrasion than natural rubber. Some of these tires of synthetic rubber are being exhibited at the Berlin Show by the army.—*ATZ*, Feb. 15.

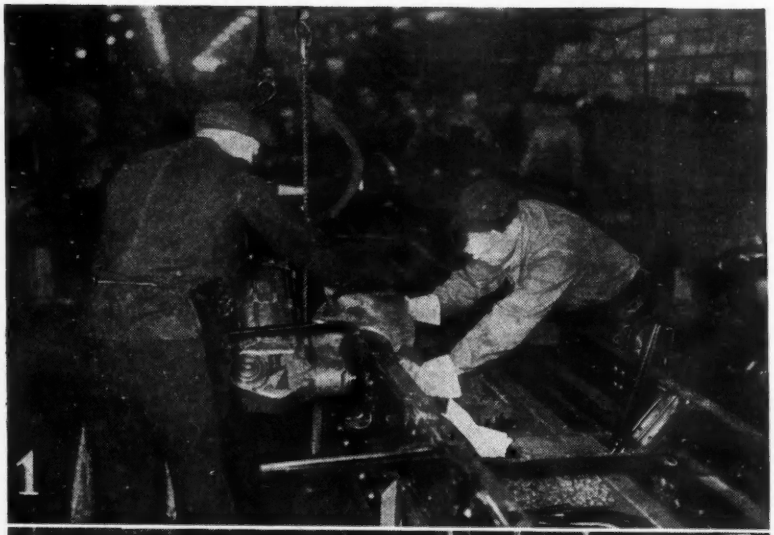
France Bids for Racing Prestige

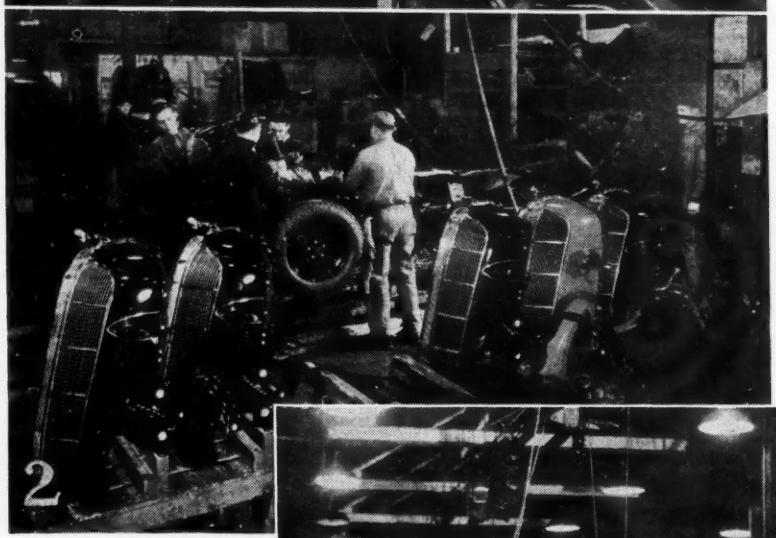
THE appeal which was made to the French automobile industry and trade and to the general public last year for contributions to a fund intended to finance a French racing team in international automobile races met with practically no response, and the plan of building a super-racer for these competitions has been abandoned. A substitute plan to reestablish French prestige in the racing world has now been worked out and will be applied in a Grand Prix race which is to be held next summer. It is argued that in the races of recent years, features of design and fuels have been used which have little chance of application in stock cars, and the rules of the coming Grand Prix are to be so drawn that the race will be restricted to modified stock cars. Superchargers will not be allowed. The displacement will be limited to 4 liters or 244 cu. in. Either commercial gasoline can be used as fuel or else a mixture composed of 64 per cent gasoline, 18 per cent benzol and 18 per cent alcohol, which was the fuel used in the French Grand Prix of 1930. —*The Engineer*, Jan. 31.

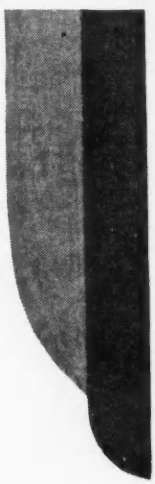
Michel Diesel

THE Michel two-stroke high-speed Diesel engine, a German design, has been taken up in England by the firm of Lloyd and Ross of London. At the recent Shipping, Engineering and Machinery Exhibition in Olympia, London, a "four-star" (twelve-cylinder) engine of this design was shown on the stand of Teckson Development, Ltd. The bore was 67 mm., the combined stroke of the three pistons of one "star," 348 mm., total displacement 229 cu. in. and the output was given as 120-180 hp. at 1750-2000 r.p.m. The specific weight was given as 10 lb. per hp.

Dodge Plant Improvements Continue







AN excellent example of the constant improvement in plant and equipment may be found in the truck plant of the Dodge Division of Chrysler Motors. When we described the plant in AUTOMOTIVE INDUSTRIES, Aug. 25, 1935, it was newly equipped for 1935 production. Yet in this brief interval, the plant has been further refined and its operations expanded to take care of 1936 production.

The group of illustrations shown here gives an impression of Dodge truck plant as you see it today, pushing out the augmented 1936 line.

1—This riveter actually squeezes a head on to the rivet. When compressed air is applied the piston head slowly contacts with the rivet. The heavy backing support clamp which extends to the other side of the rivet receives the pressure impact of this movement. Only a slight hissing noise is heard.

2—This view shows a part of the department which assembles the complete radiator. The men in the background place it on the chassis.

3—Here the chassis is ready for the body. When the unit reaches this point it is handled by an overhead crane which carries it around a corner where it is placed on a conveyor belt for the mounting of the body.

4—This operation in the Dodge truck plant shows the mounting of the body upon the completed chassis.

JUST AMONG OURSELVES

Financing Holds Profitable Course

RATE cuts in financing charges on automobiles are not expected to reduce earnings of finance companies, according to various reports which have been received in the last couple of weeks. Some finance companies have seen already indications that the lower rates will be offset by increases in volume of business. A West Coast subsidiary of C.I.T., for example, did 40 per cent more business in 1935 than in 1934, in spite of Bank of America competition.

Now that the time of the year is here when companies explain themselves to their stockholders *per* annual reports, some other disclosures of interest are here. In some quarters it is said that rate cuts on financing would have come without the pressure of competition, and that a favorable result of the cuts has been that some banks were prevented by them from entering the financing business. The last point, considered as a motivating cause, is somewhat doubtful. There are too many other reasons why some banks could not enter successfully the financing field.

Allis-Chalmers, Worthington Pump, and Marion Steam Shovel have signed up to use C.I.T. services. In the field of heavy equipment represented by these companies lies another means by which financing operations can be spread for protection against the hazards of a too-concentrated business.

Trucking Provides A Host of Positions

IN a speech at Baltimore, John L. Rogers, director of the Bureau of Motor Carriers of the I.C.C., said that 120,000 applications from truckers have been filed for qualification under the "grandfather clause" of the Motor Carrier Act. Mr. Rogers estimates that a million vehicles are operated by those who filed the applications, and concludes from this that trucking alone is a more important industry than the railroads, because of the amount of employment it provides. This is on the basis of the known registrations. There are, undoubtedly, thousands of private, single-truck carriers and operators in the country, who add their quotas to the number of those employed by trucking.

Effect of Term On Financing

DISCUSSING the effect of long-term paper (many automobiles are being sold on installment contracts running from 24 to 29 months) on the working capital of finance companies, Milan V. Ayres, analyst of the National Association of Sales Finance Companies, says:

". . . If the average life of installment contracts is to be doubled, finance companies, to finance the same volume of sales, will require nearly twice as much capital invested in installment paper, and if called upon to liquidate all or any part of their holdings will need nearly twice as long a time for the process."

Assuming a constant monthly volume of purchases, it takes twice as long for the outstandings of 24-month paper to become constant as it does in the case of 12-month paper, and twice as long to complete liquidation from a given date.

These facts have, of course, important bearing on the economics of credit in the United States, and simple as they may seem, are worth the reflection which we hope will be stimulated by Mr. Ayres' restatement of them.

Analysis of Dealer Losses Completed

WITH certain changes in the positioning of various items, Edward Payton has completed for the National Automobile Dealers Association a composite study of the operations of 1058 automobile dealers during the year 1934.

The dealers who cooperated in the survey on which Mr. Payton's study was based sustained a net loss on 325,364 used cars traded of $13,340,130 for the year, more than offsetting the $8,685,303 of profit on the retail delivery of 193,909 new cars.

With the inclusion of stockroom and service-operation profits there was a final operating net loss for the 1058 dealers of $684,894, or $3.53 per new car delivered at retail, and this, as Mr. Payton points out, on a total sales volume for all departments of nearly $300 million.

Granting dealers should have an opportunity to make a profit of 5 per cent on retail new car sales, and figuring this unrealized opportunity to be valued at $8,083,903, Mr. Payton believes that the *real* loss of the 1058 dealers amounted to $11,661,754 in 1934, or $60.14 for each new car sold at retail.

According to Mr. Payton, factory discounts to these dealers were cut an average of 2.60 per cent in 1934 as compared to 1933. This alone, he concludes, was enough to wipe out 52 per cent of the dealers' opportunity to realize a 5 per cent profit. In 1934, he points out, dealers reduced their used-car gross loss per unit, but $1.62 per unit more than they made up in the reduction of this loss was taken away in reduced discounts.

—H. H.

The FORUM

Yes, the North-Lucas Was Built

Editor, AUTOMOTIVE INDUSTRIES:

In the interesting letter which you published in your issue of Jan. 4, Stanley B. Arnold refers to the North-Lucas experimental car and seems in doubt as to whether this remarkable vehicle was ever actually constructed. Your readers may be interested to know that it was tested on the roads by members of our staff in December, 1922, and subsequently covered many thousands of miles, although for various reasons it was never developed commercially.

I think that the designers of this car deserve special praise for their far-sightedness. Here are a few of its features, many of which are thought ultra-modern today:

Body and chassis combined in a single structure with some attempt at streamlining.

Five-cylinder radial engine mounted at the back with the crankshaft axis vertical.

Engine, gearbox and final drive constructed as a single demountable unit.

Independent suspension at the front and rear by radius arms reacting against enclosed coil springs and telescopic hydraulic shock absorbers.

The engine had a bore and stroke of 70 m.m. and 76 m.m. respectively, giving a capacity of about 92 cu. in. There was a horizontal, bladed flywheel at the top, which delivered air downwards over the cylinder fins. Built as a unit beneath the crankcase, a transmission case enclosed a conventional gearbox and a worm and wheel final drive. Power was taken to the rear wheels through open cardan shafts.

This car was built as the result of collaboration between O. D. North, a well-known British engineer, who has since done much to develop six-wheel goods vehicles, and R. Lucas, a motoring enthusiast. I enclose an old photograph of the car in case this should interest your readers.

MAURICE PLATT,
Technical Editor, *The Motor.*

Mr. Aske is Questioned

Editor, AUTOMOTIVE INDUSTRIES:

In the very interesting article: "Iron and Copper Bonded in Composite Cylinder Heads," by Irving E. Aske, which appeared in the November 30 issue of AUTOMOTIVE INDUSTRIES, I find several statements and a line of reasoning which appear to me rather questionable.

Mr. Aske tries to determine the relative efficiencies of copper, aluminum and iron as regards absorption and conduction of heat from the surface of the cylinder head. As a measure of this efficiency, he proposes an "absorption factor" which he defines, on a volumetric basis, as the *product* of the specific weight by the specific heat by the heat conductivity of the metal. On the strength of this reasoning and the data adduced, he arrived at the conclusion that copper is 2.8 times as effective as aluminum, and 6.3 as effective as iron.

I question the correctness of this reasoning and the applicability of the concept of an "absorption factor" as used by Mr. Aske.

The physical concept of heat conductivity as applied to metals means: Heat conductivity *within* a metal. If the metal surface is in contact with another medium from which it absorbs heat by radiation, convection or conduction, entirely different laws prevail, and the respective constants of film resistance, absorption coefficient, etc., etc., must be established in each case. It would, therefore, appear pertinent to establish the absorption coefficients for aluminum and copper under the conditions of a heat radiating body of gas in contact with these metals as is actually the case in the engine.

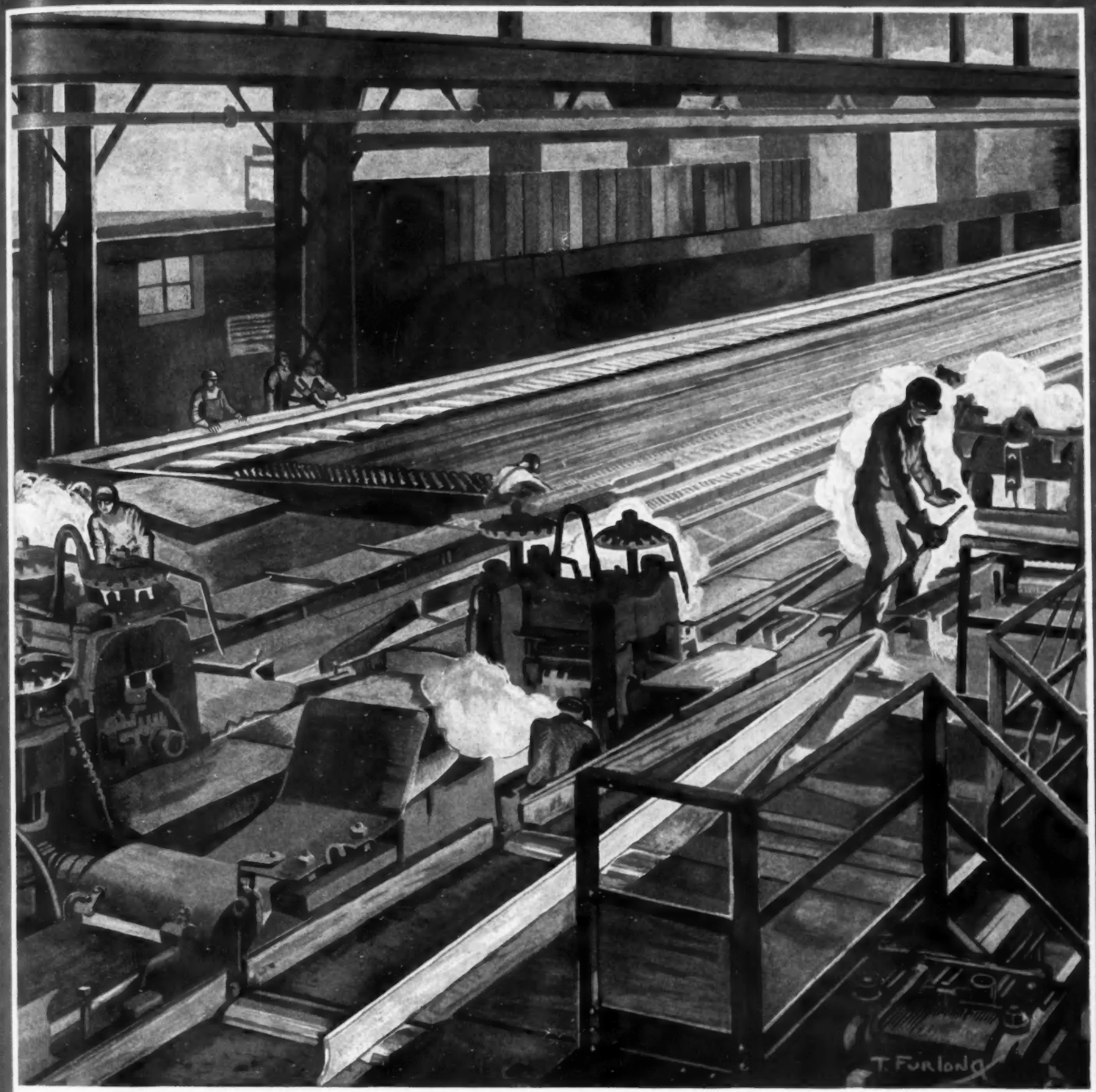
If we assume, for the sake of comparison, that, for instance, two cubes of equal dimensions, one of aluminum and the other of copper, are brought into intimate homogenous contact with two metallic bodies A of a definite temperature which is higher than the temperature of the cubes, then it is in order to apply the concept of heat conductivity. It is then assumed that one surface of each cube has initially the temperature of the body A and under these greatly simplified circumstances the heat flow and the temperature gradient through the cubes will be determined *only* by the heat conductivity of the material of which they consist, provided, that the cubes have reached a state of thermal equilibrium in which the inflow of heat into them equals the outflow of heat from them. *Before* the state of thermal equilibrium is reached, the heat flow *also depends only upon the heat conductivity,* but inasmuch as the intermediate layers of metal between two opposite surfaces must be raised to the proper temperatures, the temperature gradient during this *non-equilibrium stage* (which is probably a permanent condition within the walls of the combustion chamber) depends upon and is regulated by a function called "temperature conductivity," which is a measure of *how quickly* the equilibrium condition is reached and which has the dimensions of: heat conductivity *divided* by the product of specific weight and specific heat of the material in question.

The temperature conductivity is a quantity which enters into many problems of physics and the late English physicist Tyndall made various experiments illustrating the effects of temperature conductivity. It has been established for a great many substances and is recorded in handbooks of physics and chemistry. From the well-known handbook of Landolt-Bornstein I am quoting the following figures for the temperature conductivity of copper, aluminum and iron at or near 100 deg. C.:

Copper	1.09
Aluminum	0.819
Iron	0.153

Incidentally, according to the above handbook, the specific heat of aluminum at 100 deg. C. is 0.2122 and the specific heat of copper at 100 deg. C. is 0.0928, which does not agree with the figures quoted by Mr. Aske.

It is the *temperature conductivity* and *not* the *"absorption factor,"* introduced by Mr. Aske, *which governs the cooling of a metallic surface.* There is really nothing very complicated about this problem; it would seem rather obvious that of two metal sheets



IN the Bar Mills of the Bethlehem Steel Company plants are men who have had years of experience in the manufacture of that one class of product. The latest facilities are at their disposal, but as in the making of any product, experience and know-how count in the final result. In buying bars from Bethlehem the automobile manufacturer can rest confident that he has placed his order with a house which combines length of experience and the fullest facilities.

BETHLEHEM STEEL COMPANY

GENERAL OFFICES: BETHLEHEM, PA.

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for the Automotive Industries

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WITH a new continuous sheet and strip mill, embodying all the latest refinements in rolling and finishing equipment, Bethlehem is in position to meet every automotive requirement for sheets and strip, coiled and flat, including cold-rolled sheets for doors, hoods, panels, and major body sections; lamp and crown-fender stock; and both hot-rolled and cold-rolled strip.

Experience derived from a long-standing close association with the body industry as a maker of automobile sheets, backed up by a mill that represents the last word in rolling and finishing equipment, makes Bethlehem the kind of source for sheets or strip that the body maker can depend upon for either his usual or unusual needs.

ALLOY STEELS

THE insistent demands of the automotive industry for steels of ever greater strength and durability have been consistently met by Bethlehem as a major producer of alloy steels since their earliest use.

In close cooperation with automobile plant metallurgists and placing its complete facilities at their command, Bethlehem develops and produces alloy steels with the properties sought by automotive engineers for the faster, safer motor cars of today.

SPECIAL ROLLED SECTIONS

IMPORTANT economies in the manufacture of a wide variety of parts can often be effected by the use of Bethlehem Special Rolled Sections, many of which have been especially developed for automotive use.

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THE use of Silvery Mayari Alloy Iron results in fine-grained, readily machinable high-strength castings at low cost. Silvery Mayari Iron has a natural nickel and chromium content, combined with silicon content of from 9 to 12 per cent. Only a small percentage of Silvery Mayari is required in the cupola mixture to effect improvement in automobile cylinder blocks.

Because of its economy and unusual effectiveness, Silvery Mayari is now being used in the cylinder-block castings for leading makes of automobiles.

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BETHLEHEM is particularly well equipped to supply special-purpose carbon steels suited to the needs of automobile manufacturers. Physical properties are accurately adjusted to meet requirements of use. Such adjustments include control of grain size, when so ordered or specified.

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EVERY detail in the manufacture of Bethlehem Tool Steels is handled in the way that long experience has shown to result in the finest product. For each of the many exacting tool-steel uses in the automotive industry there is a grade of Bethlehem Tool Steel that will meet every demand.

STAINLESS STEELS

THE various grades of Bethadur in conjunction with Bethalon, known for its easy machinability, cover every requirement for stainless steels. Bethlehem metallurgists will cooperate in the selection of the grade for any requirement.

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BOLT and screw wire; spoke wire; spring wire. Bethanized (special zinc-coated) wire.

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BETHLEHEM'S large, self-contained Lebanon plant is devoted wholly to the manufacture of bolts, nuts and related products, and produces a complete range of standard items, and many "specials."

Bethlehem District Offices are located at Albany, Atlanta, Baltimore, Boston, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Honolulu, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, San Antonio, San Francisco, St. Louis, St. Paul, Seattle, Syracuse, Washington, Wilkes-Barre, York. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

GENERAL OFFICES: BETHLEHEM, PA.

which, let us assume for the sake of simplicity, have the *same* heat conductivity and undergo the *same loss of heat* in calories, the one with the greater *product* of specific heat by specific weight will show in the same interval of time a *smaller drop in temperature* and *not a greater drop*, as Mr. Aske seems inclined to believe.

Of course, one may argue that out of the two above mentioned metal sheets, the one with the greater product of specific heat by specific weight, will, by the same token, with a given *inflow* of calories, show a smaller *increase* in temperature. This is certainly true, but in this case we have no right to speak of heat conductivity because the amount of heat which a copper and an aluminum surface may absorb from a hot body of gas, does not depend upon the heat conductivity of the metal, but primarily upon film resistance, the absorption coefficient, etc., etc., which quantities Mr. Aske did not consider at all in his article.

In fact, if technological factors are to be taken into account and if we shift from a purely theoretical to a more practical analysis of the technical devices, mentioned by Mr. Aske, one would have to say that the thermal constants of both the aluminum and the copper cylinder heads must, after a rather short time, undergo appreciable modifications, not only from a deposition of carbon within the combustion chamber, but probably even to a greater extent from the deposition of insoluble and heat-insulating deposits in the water jacket, which have a considerable effect, unless they are removed. It would also appear rather questionable whether in practice the cooling of the cylinder heads alone can have a major effect on detonation in view of the fact that the pistons and exhaust valves run at appreciably higher temperatures than the cylinder head and, therefore, must have a greater effect in enhancing detonation. In the case of the exhaust valves, this can be sometimes counteracted by the proper location of the spark plugs, but this remedy is not available in the case of the pistons.

DR. EDWARD SOKAL.

Before replying to the above comments on my article, "Iron and Copper Bonded in Composite Cylinder Heads," which appeared in the November 30 issue of AUTOMOTIVE INDUSTRIES, I want to correct two errors in the original article. The specific heat of aluminum, given as 0.122, should have been 0.212, and the product 0.178 should have been 0.1718. With this correction, I agree with your correspondent regarding the constants used for copper and aluminum.

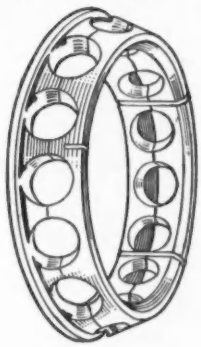
I am inclined also to agree with his analysis of the thermal factors involved. The term "temperature conductivity" would be more accurate from a theoretical standpoint than the term "absorption factor," used by myself in attempting to picture a condition under which heat is rapidly abstracted from the last gas to burn in the combustion chamber. There are so many factors, most of them unknown, that would have to be considered in arriving at a correct comparison of the cooling efficiencies of the three metals, that I dismissed the subject on the basis of the respective physical properties of the metals involved.

I therefore defend the term "absorption factor" only upon the basis of its implied meaning, the power or function of a metal to extract heat quickly by virtue of its specific heat, specific weight and conductivity. I must confess that the term is of my own invention and possibly unscientific.

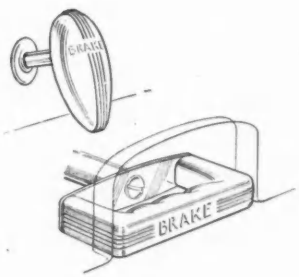
The question remaining is the numerical value of the term "absorption factor." Is it the product of specific heat times specific weight times conductivity or the quotient obtained by dividing the coefficient of thermal

WHAT'S NEW IN *Plastics?*

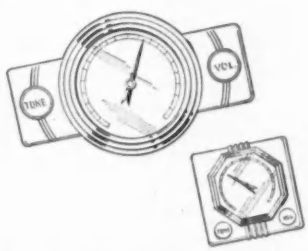
THIS MONTH: Bearing Retainer Rings, Brake Grips, Radio Escutcheons



Bearing Retainer Rings: Instead of machining bearing retainer rings from laminated phenolic sheets, with great waste and high cost, why not mold them of friction-resistant Durez? Mold them in halves, assembling them with spring-wire clips which snap into molded-in recesses. Oil-retainer undercut easily machined in. Advantages: light weight, wear-resistance, lower cost.



Emergency Brake Grips: As front compartment floors are cleared, emergency brakes go up on the dash. Here are two thoughts on Durez brake grips. Top is a tear-dropped version, rounded so it won't nick your knees, with finger-grooves in back. Molded over core-rod, if desired. Other sketch shows flush-type, fitting into recess stamped into dash and attaching to rigid metal plate. No core necessary. Light, pleasing to touch, wear-proof lustre, amply strong.



Radio Escutcheons: For smart, contrasting, non-glaring radio escutcheons for the dash, mold them of Durez. Molded-in inserts for attaching, and all holes, bezels, flutes, ribs or engraving produced in one operation. Using blacks, browns, tans or maroons to harmonize or contrast with dash-trim, and light-colored plastic controls.

Extra Strength: For molded parts getting rough usage, try Durez 1544 or 1547 compounds. Two and three times stronger on impact, respectively, than regular materials, and best of all they have a smooth, glossy lustre. Both may be machined and then repolished.

DUREZ is a hot-molded plastic supplied either in molding compound form or as resins for impregnating, coating, etc., or in sheet form. We are anxious to work with you in adapting this versatile material to your needs. General Plastics, Inc., 23 Walck Road, North Tonawanda, N. Y.

Choice of the Motor Industry **DUREZ** · *Plastic Materials*

conductivity by the product of specific heat and specific weight? If it is the latter, the value 0.731 for copper will be 1.4 times that of aluminum instead of the ratio 2.8 which is the figure used in my article. Considering the quotient basis, it is readily observed that the value for any metal decreases as the specific heat increases or improves in value.

It is difficult to believe that the greater the specific heat for a given metal the shorter becomes the time required to establish temperature equilibrium within the metal; for instance, if the specific heat of copper were increased from 0.092 to 0.212, the value 0.731 would drop to 0.317, a value which is much less than that of aluminum. On that basis, copper would be inferior to aluminum for insert purposes. In other words, the higher the specific heat or thermal capacity of the metal, the less efficient it becomes as a cooling medium for insert purposes, a condition quite contrary to reason.

The deposition of scale over the water-cooled area and carbon forming over the combustion surface will tend to reduce the cooling efficiencies of the two metals, copper and aluminum, and make them more nearly equal.

Experimental tests that we have conducted on combustion chambers of iron with and without copper inserts shows that copper exerts a major effect in controlling detonation. It is true, of course, that the exhaust valves and piston run at a much higher temperature than the cylinder head, but inasmuch as detonation generally originates within the clearance zone, the effect of the cooled copper more than offsets the influence of the exhaust valves and piston for any given chamber. The location of the spark plug does have a bearing on the temperature of the exhaust valve; if the plug is improperly located, it can even cause the valve to glow and preignite the incoming charge.

I. E. ASKE.

DERMA-SAN
DISINFECTANT
BE CAREFUL
DANGER
HOW TO
STOP
LOOK
SAFELY
NO SAFETY PROGRAM IS COMPLETE
THAT IGNORES "Oil Dermatitis"
MANY a perfect safety record has been shattered by Oil Dermatitis. Carried from worker to worker by cutting lubricants infected during use, this serious skin disease cripples production... causes compensation payments. Guard your men against infection by using Derma-San. Just add 1 pint of Derma-San to 35 gals. of cutting lubricant, and kill dangerous pus-forming germs before they attack your workers.
Derma-San is ideal for all general plant sanitation
The HUNTINGTON LABORATORIES Inc.
DENVER
HUNTINGTON, INDIANA
TORONTO

Positive Displacement Vane-Type Blower

(Continued from page 408)

sion of the A.A.A. Contest Board to further limit fuel consumption in the 1936 Indianapolis race will have the effect of increasing the importance of fuel economy in the race, bringing it to a par with speed and endurance. The rules again permit of the use of superchargers. He thinks, moreover, that the positive-displacement supercharger has advantages over the centrifugal type in that it minimizes heating of the charge and obviates the possibility of overcharging. An efficient charger, Mr. Kratzer points out, cannot be considered a load on the engine, since the power required to force the charge through the intake tract, if not supplied by the charger, would have to be supplied by the engine directly. By using a supercharger designed to give a 100 per cent charge at maximum engine speed, the engine can be made to operate at high speed at the compression for which it was designed.

The Horizons of Business

(Continued from page 409)

ministration deficit of 16 billion seems fraught with an emergency character which has not applied to any of the earlier billions. American business is again asked to serve as the guinea pig in the laboratory of reform and experimentation. Congress is again asked to approve a far reaching measure before it or the country have had an adequate opportunity to examine the proposal.